SUPPLEMENT.

The Mining Journal,

AILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

1656.—Vol. XXXVII. LONDON, SATURDAY, MAY 18, 1867. {STAMPED .. SIXPENCE. UNSTAMPED. FIVEPENCE.

MACHINERY FOR CUTTING, TUNNELLING, QUAR-G, AND FACING SLATE, STONE, AND MARBLES.

BY W. FOTHERGILL COOKE, ESQ.*

us muris cinxisse Semiramis urbem."
mis is said to have surrounded the city with burnt-brick walls.

as the defensive material for fortifications in the days of ; and the grand old temples and palaces of Nineveh, ted with richly-sculptured slabs of limestone, or precious ver bricks (burnt or unburnt), stood forth with well-con-eandeur and apparent solidity. The Romans and the Lug-of their day, conjointly reversed the practice; and whilst n general fortified the city with stone ramparts, the Lon-ens raised their habitations in fiery red bricks. Stone is hilst clay is still abundant in the precincts of London; and coal cheaply converts the subsoil into the most handy of naterials. Not only is stone scarce, and expensive in the ck, but the finished and ornamental working of it is most d even a thin casing of the stone adds from 50 to 75 per he architect's estimate for a frontage alone. I trust this o introduce to my hearers some novelties in the machinery g rock, and working stone for ornamental purposes, which urage our architects and builders to adopt stone instead of brick and Roman cement in their future elevations, and up a prospect of a better architectural future for at least rn streets and mansions. Stone, of good building qualities worked, is abundant in many parts of Great Britain; and es of carriage by canal, rail, and sea would not materially use in the better class of buildings, if it could be worked nomically, and sent up in a quite, or nearly, finished state quarry. A class of stone rarely or never seen, I believe, in uildings, but much used in the best buildings in North Wales parts of England—the tertiary limestone—is very durable , and takes an excellent face, almost approaching to a polish, new tool. Sandstones, Portland, Caen, and Bathstone, are softer, and mostly less durable, than limestone, but not more rked.

ery, which has been so widely applied to other trades, has done but little for masonry, though in this remark I confine masonry proper, not including sculpturing by machinery. the sand-saw, and occasionally by the circular toothed-e has hitherto been worked chiefly by hand. I wish here to at the harder stones, including the granites and granite-, cannot be operated upon by this machinery at all. This , which I will now proceed to describe, depends chiefly for on the peculiar forms of the cutting tools or moveable tly, in the application of them as attached to holders, or xed in the edges of the blade, instead of the blade itself he cutting edge; and, secondly, as applied to the circum-cylinders for surfacing. The tools, or cutting-teeth, are, ence of their being moveable in the sockets, easily replaced d without any reduction of the diameter of the blade, which nders the circular saw, when applied to the cutting of stone celess. These moveable tools, or teeth, are capable of ap-o machinery for a variety of purposes; firstly, to the saw-cks and slabs of rocks of considerable thickness, for build-er purposes; secondly, for facing the surface of squared-up n ornamental manner; thirdly, for tunnelling, for under-one, slate, or coal *in situ*, where the rock lies more or less line, and also for the vertical cutting of the living rock readily as a haycutter cuts hay out of a stack. These tools, held in moveable sockets, are, as I have said, the dis-atures of this machinery, and they are exclusively the in-f Mr. George Hunter (now of Maentwrog, North Wales). r's saws," with the improvements which have rendered them e for very many purposes, are becoming well-known in d Kingdom. They are most extensively used in North d last autumn Mr. George Hunter put up one at South r the Commissioners of the Tyne Navigation. The dia-he blades in this saw was 7 ft., and it carries two blades on It is employed to cut the limestone of the neighbourhood rbour works. The performance of this saw gave such sa-that a second was speedily ordered to carry two blades of neter each. The gigantic machine is now finished, and edily at work upon the same limestone. Its depth of cut t. As there is no reason why the 13-ft. saw should not asily as those of 7 ft., the success of this machine will, I ent, attract the attention of engineers and contractors to bility of this means of squaring large stones for harbour r purposes, where size, economy, and time are always of portance. As it is known to many now present that my is united with Mr. Hunter's in several recent patents, I e that my share has chiefly consisted in extending the ap-f the moveable tools and tool-holders (the real essence of on) to fresh and wider fields of usefulness, whilst the onus g the machinery to each novel application, and in so doing an entirely new result, has fallen upon the inventive ge-echanical skill of Mr. George Hunter.

gram represents the moveable cutting tool, now most in in its holder or socket. It is a bolt made of the best rod head is forged into a cupped or trumpet form—turned, and ned. When in use it is simply slipped into its socket, lso made of steel, and wedged tight by a piece of paper or ving of wood. When the edge is dulled or chipped the ed in its socket so as to offer a fresh cutting margin, and, away chiefly on the advancing side, the tool will gene-three, sometimes four, fresh surfaces before it is worn out. s, according to the circumference of the saw blade, are inches long, and the cutting head itself from ¼ inch to le. The length of the bolt allows of the tool being soft-n set up, turned, and hardened, until it is too short for . The stems of the sockets are of the same thickness as the blades that receive them, and are slipped into grooved openings in the margin of the blades, to which they are fitted with accuracy by machinery. As the blades revolve slowly, the tools are usually replaced, or merely turned round in their sockets when necessary, without stopping the machine, and should thus be kept always in good cutting order. The cupping, shaping, and tempering of these tools require modification in each case, to adapt them to the texture of different kinds of stone. Limestone and sandstone, for example, cut away in large chips, whilst slate has to be scraped away, and the tool must be made to suit each case. The next tool to which I will. direct your attention is formed by the double action of a punch The first action cuts out a round disc from a plate of steel, like the punching of a boiler plate; the second action converts the disc into a tool, precisely similar to the head of the bolt-like tool just described, only ready cupped and sharpened; with a boss behind, to fit into a corresponding groove in the back of its holder, and with a hollow in front for a nipping bolt, or pinching screw, to grip it. These discs, so punched into the exact form required, only need tempering to be at once fit for use. The holder of the disc-tool grasps it between (as it were) its finger and thumb with perfect firmness, and as the cutting rim projects only very slightly beyond the holder, it offers very little leverage to the resistance of the stone, and never gets loose or displaced. Either of these forms of tools may frequently be used for the same object, but each has its specific application as well. I must now introduce you to another form of tool, equally simple in its character with the last, but peculiar in its adaptation to a distinct purpose. It is formed out of a symmetrical acute-angled trapezium, cut from a riband of steel, two or three sixteenths of an inch thick, according to the roughness of the work it has to do. To convert these slips of steel into the required form of tool they are bent sharply on their middle, so as to bring the acute angles opposite to each other, but slightly turned out at their cutting angles. These tools are cut from the ribands of steel without any waste, and if not left sufficiently sharp by the shears, a number of the flat slips are screwed up together in the vice, and sharpened by the file; they are then bent and hardened, and fit for use. The socket for this form of tool is extremely simple; it is merely a hole into which the tool slips, and in which it is held by the spring of its own arms. The chief use of this tool will be the roughing down grindstones, and in scarifying the rough surface of slate and stones, preparatory to the facing tool, and is, perhaps, the best form of tool for under-cutting coal. In addition to those already described, there are flat, concave, and other formed tools, all adapted to the holders, for giving ornamental and apparently hand-tooled surfaces to ashlers, quoins, sills, &c.; but as I shall have occasion presently to call further attention to them, I will not here dwell upon the subject.

I now turn to the application of these simple, cheap, and effective weapons to various forms of machinery:—First in order comes the "Hunter's saw." The diagram attached is so clear that it almost tells its own tale; it is taken from the small hand model upon the table. In the mechanism of the machine itself there is but little novelty, and it may be worked by any suitable power. It consists of a table moving on V-grooves, or on friction-pulleys, to which the stone to be cut is fixed by cramps, or when very massive and rough, as at Newcastle, by chains. The table is fed forward by a self-acting screw, and advances upon the cutting-blades at a speed of from 3 in. to 6 in. per minute, the speed varying with the work to be done and the nature of the stone. The cutting-blades, running from one to four in number, are fixed to collars, which traverse on an axle above the table, supported by uprights, and moved by a train of wheels in the usual manner. For adjusting the width, pinching-screws in the collar of the cutters are slacked, and the blades are then pushed or worked by ratchet along the axle, and can thus be set apart to correspond with the width of any stone that the table can carry. In the diagram, as well as in the foregoing description, the saw-blades are represented as working above the table, but they are not necessarily or always so placed, except when the stone or slate to be cut into slabs or blocks is of variable widths, and the blades have to be moved on the axle to correspond therewith. When the blades are above the table, the tools are made to cut upwards from below, by which the working of the machine is eased, as each tool slides smoothly at first into the groove formed by the preceding tool, and then cuts boldly out at the top of the slab in its own new path. But when the blades are carried on an axle below the table, the cut must be from above downwards. If these arrangements are reversed, the tools will come *aplomb* on the stone with a jarring blow, and tend to drag it into the cutter, when the result may be the crumpling of the blade, or the stripping off of the tools from their holders. Before leaving this machine I will state that, for cutting window-sills, door-posts, steps, coping-stones, and a host of other building materials, out of rough blocks of slate—which were formerly necessarily thrown away as useless, because there were no means of working them—we employ now three or four blades of 4 feet diameter, all cutting at the same time upon the same axle. These blocks, frequently 12 in. to 16 inches thick, and weighing several tons, are simultaneously reduced to five thick slices, and immediately split up into the required thicknesses for planing, or tooling, as most suitable. An immense amount of paying work is thus turned out of rock, formerly all thrown away, and still accumulating by thousands of tons yearly on some of the giant and wasteful rubbish heaps of the Welsh slate quarries. At quarries in which I have a considerable interest there are now three, and will shortly be seven, saw-tables of large dimensions in busy and productive work—converting everything of value into slates, slabs, or building materials. Under a recent improvement we use a succession of tables always advancing, on which the blocks are prepared before the saw is ready for them, which saves the time of running back the table, unloading, and preparing another block. Thus, so soon as the first cut is completed, the saw-blades are re-adjusted for the next block, the first table is brought on, and the other passes forward under a crane, where the block is re-adjusted for the next cuts, or, when finished, removed to be split up for the planes, and the table is either sent forward to the next saw with a fresh load, or lifted by the crane on to a line of rails parallel to the series of saws, and run back to commence its course again. The next application of the movable cutting-tools which I will describe differs but little in principle from the last, but is productive of very different results. The axle of the cutters is still above the table, but capable of being raised or lowered, as the cutting-tools are in the ordinary engineer's plane. Instead of two or more blades fixed on their sliding collars, carrying an array of cutting-tools on their peripheries, as in the saw, the axle itself, or a removable cylinder slipped on, or bolted in halves to the axle, receives the tools.

The object of the machine now under consideration is to give a finished surface to building or other stone of a more or less ornamental character; and breadth not depth has to be cut. The tools are fixed in holders, placed spirally round the axle or cylinder, so that a divided and regular pressure may come upon the face of the stone at intervals of 2 or 3 inches, always nearly uniform, but ever passing spirally from right to left. In the specimen of ashler shown, the tools formed one spiral, each fourth tool cutting at the same time, and six tools were entering into the cut as other six were leaving. A double spiral, in which the tools followed each other more closely in their cut, would have given more uniformity of strain, but could hardly have produced a more perfect piece of work. The fluting here produced may be varied without limit, or the margin work cut by the flatting tool may be carried over the whole surface. By the introduction of a second cylinder, the beginning and end of each stone will receive a border across the stone corresponding to the long margin, of whatever pattern it might be. For fluting or similar work the punched tools have a great advantage, whether of the disc or flat-faced form, as they are always of exactly the same diameter, and produce uniform work. The marginal tool may be cut off a shamfer if required. Anything that parallel working tools on a revolving axle can execute will be done readily by this machine, and on a larger cylinder tools of a different shape may work along the same line, so as to vary a running figure by alternate markings. In fact, the outline of work thus produced seems unlimited, and figures that this machinery cannot give may leave the stone surface prepared for the sculptor. Take the instance of a Gothic church window. The perpendiculars would be easily cut out in any running pattern, on a straight moving table, by a series of tools corresponding in their forms to the required surface. These tools would be fixed on a cylinder, cast more or less in reverse of the same outline; but the same lines round the arch would render it necessary that the table carrying the stone should travel along rails or grooves, twisted accurately to the curvilinear line required for each portion of the arch. The table in this case would travel eccentrically, but for a Roman arch concentrically. These hints will readily expand themselves in the mind of every practical man. Many figures more difficult than the above have already been considered, and the means of execution planned. The roughing tool, before described, can be made to imitate the marks of a pickaxe in rustic stonework, with the usually chiselled work around it. The table for carrying the stones to be faced in continuous lines has hitherto been supposed to be the same as that used for sawing or planing ordinary slabs, but when quoin or other stones of irregular dimensions and great size have to be treated a distinct table, with a skeleton cradle, either moveable or fixed, is necessary to receive the blocks, and offer the upper surface of the stone horizontally to the facing cylinder. The irregular-shaped block thus placed is fixed by pinching-screws or wedges, and the depth of cut is regulated by the lifting-tool gear, as in a common plane. Some of the patterns of flat tooling by these machines can be made to imitate chisel-work so closely as to be distinguishable alone by the finer finish given by the machine. The shortness and sharpness of the tool-cut is regulated by the diameter of the axle, the number of cutters, and the rate of feed. The finer kinds of limestones, including specially those of the Isle of Anglesea, receive almost a polish from the cutters. These machines will be of moderate weight, except when required for the facing of massive blocks, and a very small power works them, so that they could be sent about the country to prepare the stones for a building on the spot, where an equivalent complement of masons could only be obtained by collecting them from great distances.

I will now describe the machines for cutting stone, &c., out of the living rock in the quarry itself. The principle here is, I believe, new. The cutting tools, instead of being placed in a single row around the rim of a thin blade, are fixed in rows of twos and threes alternately across the margin of a wheel-like disc, so as to clear away a wider space. The outer portion of this wheel-like disc is a ring of cast-iron, armed on the outside with tools, and carrying an ordinary cog-wheel within. Not to enter into small details of fittings, this cogged wheel is made to revolve on a broad metal plate as its axle. This broad plate is of great strength, and forms four-fifths of the diameter of the entire cutter, and can be firmly bolted to the machinery frame by any part of its surface nearest to the cogged wheel which carries the tools, and the latter so held is made to revolve by a pinion around it. This arrangement allows eccentrically-held cutters to penetrate the rock to a depth exceeding the semi-diameter of the disc. In the circular saw, with a central axle, the blade can only penetrate to so much of its semi-diameter as is clear of the axle and collar, and great force would be required to hold such a cutter up to its work in the rock, but in the machine now before us the cutter-wheel is buried in the cut up to the point at which it is held, and practically allows of a cutter of 3 ft. 4 in. in diameter burying itself to the depth of 2 ft. 3 in.; and, as the cutter cuts out at a chord smaller than the diameter, the tendency of the out-coming tools is to draw the cutter into the cut, instead of forcing it out. A machine of this kind, cutting horizontally, works with great freedom, and advances rapidly through slate rock, upon which it is employed. But when a cutting wheel on this principle is applied to make a vertical cut, a still smaller surface of the broad axle plate is occupied by the holder, as it can in that position be grasped on both sides, and the axle carrying the pinion can be passed through the wheel and supported upon double bearings. The machinery, including the cutter-wheel for vertical cutting, is fixed on a carriage running upon rails, and worked by a wire-rope. The cutter-wheel is gradually brought down from its travelling position, by a worm and worm-wheel, to press upon the rock till it buries itself up to the holder, when it is fed forward by a self-working screw, attached by chain and swivel to some point in advance, or by wind-

*Paper read at the Society of Arts on Wednesday, May 15.

ing directly upon a chain. A tolerable level having been first obtained on the face of the quarry, and a line of rails pinned down in the direction of the cut to be made across the greatest length, the machine commences its advance, leaving a deep groove behind it 2 or 3 in. wide, and 2, 3, or 4 feet deep. A series of parallel cuts may afterwards be made, or two disc-cutters on the same carriage-frame may be advantageously used to make two cuts at a time. An opening at the commencement of the first cut end must then be got out by blasting or otherwise; but afterwards, if the rock has any sort of cleavage or layering, it may be wedged up from below. The rock from between the first two cuts being thus removed, the vertical cutter may readily be applied to cross-cut the longitudinal grooves into squared blocks, to be removed by under wedging, or partial undercutting, when there is not a favourable cleavage. The principle of the "under-cutting" machine is precisely the same as that of the vertical cutter. The cutter-plate, however, has to be held horizontally on one side only. The cutter lies under the frame that carries it, and is advanced into its cut by worm-screw and worm-wheel, as already described. When buried up to its holder in the rock the cutter traverses along a slide-frame 12 ft. long; at the end of the 12 ft. the slide and its carriage-frame is pushed forward on its wheels for another length, and there fixed so as to leave the cutter free in its previous cut, which again proceeds on its journey, fed forward by its self-feeding screw, and so on to the end of the opening. The photographs of this machine exhibit all the details of its construction, which cannot be popularly explained without illustrations. The exposed parts of all these machines are very strong, and although shattered pieces of rock coming down upon the cutter-disc may momentarily impede its working, no injury to the machinery follows. The masses of stone cannot crush the disc, and the power employed in working the machine is not sufficient to break the wheel work.

There are other applications of these moveable cutters which I would gladly have introduced to the attention of the society this evening, especially the coal-cutter, but the time allotted is too short for my venturing upon them on the present occasion. There are some photographs, however, which display the formidable character of the tunnelling machines. One form includes in its construction two parallel borers, cutting two tunnels, each 5 ft. 4 in. in diameter, side by side, and freeing two cores, weighing more than 2 tons each at every cut. The slab of slate, still marked at its ends by the cutting tools, indicates the size of the pieces of slate that may be won by it. From one core, and that one the first ever cut by that machine, twenty-three slabs of more than 1 ton in weight were made, besides a considerable number of slates. Its rate of progres in cutting is 8 inches per hour, and the depth of cut allowed by the cutting blades is 21 inches forward. This machine has penetrated many yards into the solid slate bed, and is destined, I fully believe, to revolutionise the present system of quarrying that valuable material.

Other photographs represent another form of the tunneller, which is now being erected in a quarry of the Festiniog Valley. It will cut a single tunnel 6¼ ft. in diameter, and penetrate 28 in. at each cut. The principle explained in the "under-cutting" is employed here, only the solid central holder, for the axle-plate, is here opened in the centre as a ring, round which the cog-toothed cutter-ring revolves; and the latter, instead of carrying the moveable tools on its periphery, in the same plane, carries three segment blades of steel, projecting forward, at the extremity of which a series of cutting tools are fixed, as in the saw-blades. The carriage on this machine is fixed in the tunnel immoveably by bolt-screws, and the massive working parts gradually screw themselves forward as the cutters penetrate the rock. The open passage is preserved through the centre of the ring-frame and ring-cutter, to the front of the work, even whilst the machine is in action, through which the core, after cleaving up, is more readily removed than from the double tunnelling machine. This machine will remove more than 5 tons at a cut.

A high authority in engineering has lately condemned this principle of "planing" out a rim round a core as a mistake. I hope before the end of this month to prove a second marvellous success with a second machine: 5 feet to 6 feet 6 inches will be no trifling advance in a second tunnelling machine; but a much larger diameter for mere tunnel driving will only facilitate its working, as it will admit of more space for strength. At all events, this machine admits of the greatest facility for replacing the tools, if blunted or worn by encountering hard matter in the rock. The feeding screw is simply run back, and the tools are examined and replaced without removing the framework from its fixed position. Generally the tools retain their sharpness throughout the cut. It must be remembered that these machines were made expressly for slate rock tunnelling, and have not yet been tried on sandstone or limestone rock for tunnelling purposes, which may offer fresh difficulties, only, I hope, to be mastered, and the usual means, perseverance and resolution, never fail us in this country.

Royal School of Mines.

MR. WARINGTON SMYTH'S LECTURES ON MINING.

LECTURE LIV.—Mr. SMYTH said that, having now dwelt at some length on the various appliances used for the purpose of bringing currents of air into mines, he came to a more difficult question, and one requiring the minutest attention—viz., that of distributing the air throughout the workings of a mine. He had pointed out several contrivances for getting a current of air down one shaft and up another, and he had already mentioned that if they had to sink a great number of shafts that might not be incompatible with exceedingly bad ventilation, and that even in shallow mines in metalliferous districts the ventilation is defective, for want of a proper system of carrying the currents through the workings. With regard to "distribution," he specially directed their attention to the models in the model-room of the institution, which were very elaborately constructed, and showed with much clearness what had been done in this department of ventilation, and would enable them to understand more perfectly what he was about to lay before them orally. By the aid of a large diagram, he then showed how collieries were worked in the last century, and how the draught was carried around the levels then working, leaving the goaf unventilated. First of all, the air had to be forced or driven by doors, which doors might be divided into classes. The mining engineer should try to do with as few doors as possible; but it often happened that there were from 60 to 80 in the same mine, all of which had to be watched, as if they were improperly left open danger was the result, and damage to life and property might ensue. At Lundhill, where one of the most destructive explosions in the history of coal mining occurred, there were 50 doors within a limited area of ground.

In the first place, there were the MAIN DOORS, which are employed to shut off one part of the mine from another, and thus prevent the air taking any particular short course, and these may be made to open against the pressure, so that they are kept closed on the other side. They are constructed in an extremely permanent manner, with strong sills, because, in case of explosion, it is of the greatest importance that they should stand the shock. As with one door there would naturally be great leakage, they should be put in in pairs, so that when one door is open its partner is closed, and the general ventilation is not interfered with. Every one of these gates requires a person to be constantly stationed at it. It was clear from the accounts given of the recent explosion at Talke that the ventilation was thrown into a bad condition by one of these main doors being kept open for a length of time by an accident to a truck while passing through. The current, instead of going upon its ordinary and intended route, rushed through this open main door, and found a nearer way to the upcast, leaving all the rest of the mine without its usual supply of fresh air. The explosion probably would not have taken place if the main door at that place had been dual.

2.—Next we may take the SHETH DOOR. In following the course of the intake air we shall soon see that it requires to be turned into the bords where the working is going on, and for this purpose a bratticing is used, put in in a light way, so that it may be removed from time to time as the workings progress; and the sheth doors, which, in the same way do not require to fit very closely, turn the air from the main airways along these bratticings.

3.—Then there are DAM DOORS, which are used chiefly in mines subject to spontaneous combustion, and are put in as precautions. Thus, when a fire breaks out the dams are closed, and it is shut off from all access to the dangerous parts of the workings until measures are taken for the extinction of the mischief. These dams, to be effectual, must be constructed to be air-tight. At the undersea collieries at Whitehaven there are peculiar conditions which render them remarkably liable to spontaneous combustion, and on one occasion (in August, 1864) he went down that mine immediately after one of these fires, in the new or Forster's district, and it was remarkable how completely all danger was obviated by the facility with which the fire was isolated by means of a most efficient management of dam doors. A fire produced in the mine, and particularly by the spontaneous combustion which arises in the small coal of certain seams, in a short time produces such a smoke and "stythe" that it can only be approached on the windward side, and frequently makes it needful to retire to some distance, and bar off or isolate a whole district. To meet such cases the frames of the dam doors should be prepared beforehand at suitable spots in the main drifts, and they then perform excellent service. In the case to which he had just alluded, in the undersea collieries of Whitehaven, the Earl of Lonsdale judiciously had the lintels, &c., of dam doors prepared in the stone-drifts between faulted districts of coal. It has been proposed to put in swing doors, not only for damming, but for the main doors. In that case, they would be made to swing from a strong framework above, so that in case of an explosion, instead of their being knocked down, and their usefulness destroyed, they would be blown open, and the force of the explosion having passed, they would fall back into their old position, and maintain the division they were placed to effect.

4.—In some of the large collieries what are called MAN DOORS are used, to enable the manager or his deputy to get at the return air, for the purpose of examining it, instead of having to travel an enormous distance round. These, however, should be kept carefully locked, to prevent the men from getting through, and ought to be examined from time to time as to their integrity.

5.—Then, SHAM DOORS are occasionally used to check the current of air, and in small mines, and in some parts of larger ones, it is not unusual to employ sheets of tarpauling, to turn the air in any given way.

He now came to the subject of BRATTICES, the use of which was extremely important, in order to get the air to the places where the men were working. These consist of a moveable partition, put up so as to divide the level, the air being turned by a *sheth door* at the point where the working leaves the main level, and passed along one side of the partition, returns by the other, and re-enters the main way on the other side of the *sheth door*. By this means the incoming air can be made to sweep the very face of the coal. Bratticing of this kind is made of various materials, and a great deal of tarpauling cloth is manufactured in very long lengths for this purpose, and is much favoured on account of the rapidity with which it can be put up. Another important point is that of the STOPPINGS. Taking the diagram of a large mine, and starting from the downcast shaft, it was obvious that it would never do to put in doors in all the openings; and those that are disused are, therefore, stopped by walls of timber-work, and sometimes of brick, where there is special necessity for preventing leakage, strengthened by large accumulations of waste material thrown up on either side, to secure it in cases of explosion, and prevent its fracture from interfering with the restoration of the proper currents. When a colliery becomes extensive and complicated it is necessary to bring back one current over or under another, by means of what is called CROSSING. This is now done by what is called Lancaster's plan, which is thoroughly carried out at the Kirkless Hall and other collieries in Lancashire, and the air is carried to the far end of the workings by means which are considered very simple in character. Having shown this by drawings on the board, he remarked that in the olden time in places where there was a tendency to make gas it was not an unusual practice to take a brick out of the stopping, to allow the air to enter the enclosed portions. This, however, was a most dangerous practice, as it really did nothing but make the gas more explosive; and, therefore, if a fall of roof took place, and it were driven out on the naked candles of the men, an accident was inevitable. The necessity for any supposititious aid of this kind disappeared by the introduction, in the year 1760, by Spedding, of "coursing the air" by twos and threes through all the opened passages, and to all the places where the men were at work. The chief northern viewers soon recognised the importance of this arrangement, as opening the way to a system which would leave no part unventilated, and that, with Buddle's improvements, is the system of the present day: it divided, in fact, the ventilation. Before that all the air must pass the goaf, and driven, as it often was, 20, 30, 40, or 50 miles, it collected in the course of its journey all the fire-damp, the products of combustion, and other impurities, and it became unfit to breathe or to carry a candle in it before it reached the end of the workings. The great improvement which Mr. Buddle introduced into this system was that of SPLITTING THE AIR, which was one of the most important advances ever made in the art of ventilating collieries; but it required a great amount of care and practice in large workings. By this plan the downcast air is divided, and one part goes through one section, and another part through another section, and quite unconnected with each other, but uniting again near the upcast-shaft. Mr. Smyth then showed the diagram of a mine with the air split into sixteen different currents, all kept distinct from each other. The divisions under Mr. Buddle's plans were effected by strong ribs of coal, so that if an explosion occurred in No. 1, it need not necessarily effect No. 2, or the other panels. This plan did not require any undue multiplication of shafts, as they could see that, comparing the large area of the shaft of a colliery with that of the drifts, the former could easily supply a volume of air large enough to meet the requirements of these sub-divisions. For instance, a colliery having 10-ft. shafts would give an area of 78 square feet, while the ordinary run of levels, being 6 ft. by 5 ft., would only have an area of 30 feet—so that the shaft would pass air enough for two divisions, while a shaft of 15 ft. diameter, or 176 ft. over, would be sufficient for half-a-dozen drifts of the ordinary dimensions.

LECTURE LV.—The great value, however, of this system of separating the principal air current into different parts is the introduction of a much larger quantity of air into the mine than was formerly thought possible. In the best of the old workings it was usual to "course the air" to the places where the men were at work; but the modern plan is to ventilate every portion of the colliery, and to clear away every exudation of fire-damp or carbonic acid gas before it could become dangerous. The requirements of a mine with regard to this sub-divided ventilation vary accordingly as the workings are carried on by the longwall or pillar and stall system. Under the longwall system, if there be only two different ranges of levels, the ventilation is comparatively a small matter, although it might be necessary to get two or three splittings of air. In this mode of work the goaf may be relied on as being filled so closely that no air could get through it. And the stalls being 40 or 50 yards wide, with roadways leading to them, the face of the work and the propped up roof are swept very clean if there be a proper amount of ventilation. But if the roof behind falls in very irregularly, leaving cavities of a considerable height, there may be dangerous accumulations and explosions if the ventilation be not enough to sweep away, not only what gases are yielded by the coal, but those which are exuded from the goaf. Without this were done, every time a man working with open candles went to the goaf to fetch stone he would run a great risk of causing an explosion. The lecturer then showed by large diagrams the application of the principle of coursing the air to the longwall and pillar and stall systems, and various contrivances and stoppings arising out of special circumstances, such as a heavy fall of roof, by which explosive air accumulated in the goaf is often forced back a considerable distance towards the intake, and probably into places where it is considered safe to work with open lights. Some very material considerations affecting ventilation arose from the dip or inclination of the strata. If two shafts were sunk to different parts of a seam of coal which lay at a different angle it was not always easy to decide which should be the upcast. *A priori*, it would seem best to take the shallower shaft, sunk upon the highest part of the seam, and particularly as the gases naturally ascend to the higher parts of the levels; but, on the other hand, and particularly in deep workings, the temperature of the air will be much higher, and the specific gravity less in the neighbourhood of the longer shaft. This quality of the lighter gases gives a great deal of trouble under some circumstances. When the men are working downwards the gas leaves them; but if they are working on the rise it will constantly ascend into the very end of the works, and produces both difficulty and danger. This is especially the case in South Wales, as, from the position of the beds, the cross headings sometimes rise to so great a height that the upper parts are filled with fire-damp, and which cannot be driven down again without great difficulty to the bottom of the level. When an explosion takes places in such workings as these the bodies of the poor miners are always dreadfully charred, showing the presence of a great amount of fiery gases. In Belgium, unless especially excepted, this mode of working is forbidden by law, and the ventilation is conducted on what is called the ascensional system, by which the air was carried first to the very lowest part of the workings, and then brought up to the rise, and out at a shallowest shaft. Before, however, this plan could be adopted several other questions must come into play, such as whether their rise shaft can be made an equally good upcast pit; as to the amount of wet in the measures; and as to the relative power gained by the furnaces, which, of course, depends very much upon the height of the column required to be heated to destroy the equilibrium. A case which occurred in Westphalia excited considerable interest in the North Country viewers. It appears that the Prussian authorities compelled the miner to run a drift for a considerable distance, to reach the shallower shaft, whereas the owners (and as our viewers thought rightly) wished to bring the air down hill again to the deeper upcast. This was often done in our own collieries, when sufficient furnace-heat could be got; but if ventilating pumps or machines were used it would be an advantage to go to the shallower shaft for the extraction of the air. Some years ago it was proposed to carry off all the foul air from below by a system of pipes, which, it was stated with the greatest confidence, would prevent all danger, and some persons at the Home Office were very anxious to have it tried; but a little consideration showed that in actual mining the airways themselves are employed as pipes on a large scale, and that it would be impossible to move the vast volumes of air required in so large an area as a colliery with any such trifling means as the most wonderful system of pipes would be by comparison. It was then proposed to put down a number of bore-holes, to tap the gases below, and allow them to escape; and that if a bore-hole were put down into the crown of the goaf it would carry away all the gases which were specifically lighter than the atmosphere; but here again a variety of considerations render such a plan out of the question. Take, for instance, the cost of sinking a bore-hole through the New Red Sandstone, or other parts of the Permian formation, and the difficulty of telling which part of the goaf must be aimed at as its crown. But, more important still, the interference of such openings with the currents of air would destroy a whole area of ventilation, and destroy the possibility of any regular system, for such bore-holes would sometimes act as an upcast, and sometimes as a downcast, and would vary with every change of wind. Empirical schemes of this kind ignored, for the most part, the operation of natural laws, such, for instance, as that of Mariotte, who established the fact that the volume of a given weight of air is inversely proportioned to the weight of it; or that of Gay Lussac, that, the pressure remaining constant, the increase of volume imparted to the air by heat is uniform, and equal for each degree of heat; and that for each degree Fahrenheit of warmth the volume of air is increased by one 459th of its volume at zero—so that, if the heat of the air be t^0, it will increase the volume by $t \times \frac{1}{459}$. Applying these rules, it will be obvious—

1.—That the pressure to be overcome varies according to the length of the gallery; so that if it be so much in one mile of workings, it will in a second mile have twice as much resistance as in the first.

2.—The resistance varies according to the square of the velocity of the current. This is an important point, because it is often said that if the current will blow out a candle the ventilation is good; but this rules proves that while at one place the current may be 3 feet per second, and at another 6 feet per second, the difference does not arise from any increase in the quantity of air, but in the variation of resistance, the difference being in that case as that of 9 to 36; so that, increasing with this rapid ratio, there is an enormous loss of power.

3.—If the volume of air remains the same, the resistance varies inversely with the sectional area of the air-way, so that the larger the air-way the less resistance is offered, and the larger the volume of air obtained.

This is the groundwork of some important considerations, and more particularly those arising from the natural alteration of the size of the air-ways, in consequence of the perishable nature of the walls and roofs. Falls from the one or the other leave jagged pieces of shale, and fill a comparatively large portion of the space, so that the resistance is greatly increased, and the total volume of air introduced into a colliery so reduced as to account for many otherwise inexplicable accidents. The lecturer then exhibited a transverse section of the galleries of the Carn Brea Mine, to illustrate the conditions under which metalliferous mines are worked. There being a great number of shafts and other openings, the ventilation is often left to take its chance; but in consequence of the great heat imparted to the air in the deeper sections, and the tendency of the air in that state to rise, difficulties are met with whenever the men are up working at a long distance from a shaft. Then, indeed, comes the tug of war, and the artificial contrivances resorted to would be a great deal better with a little more attention to the principles upon which spontaneous ventilation takes place. If, for instance, care were taken that the current of air is unconnected with any other, except at the extremities, by putting in doors or stoppings, they would be enabled at all times to get a far better ventilation. He remembered a case in the United Mines, or the Clifford Amalgamated, where 100*l.* per 6 ft. was given for driving a level, and the men were exposed to a fearful temperature. The ground was excessively hard, and streaming with water, and the people were unable to work more than 8 or 10 minutes at a time, when they would rush out of the working place, and plunge themselves into the pools of water that had accumulated, and wallow in them to cool themselves, like hippopotami. The temperature was considerably above 100°, and it would have been easy to take advantage of the tendency of heated air to rise to have, by means of pipes, poured a volume of fresh air upon the face of the workings, which would then have immediately passed through and escaped by the nearest stalk. The lecturer then described a number of instruments for testing the air, mentioning particularly Biram's anenometer, a delicate instrument of great value, made by M. Casella, of Hatton-garden, and others. By these contrivances the quantity of the intake was ascertained, and the quality of the return air; and there were also admirable contrivances to show the drag on the current, and the resistance it meets with in passing through the galleries.

LECTURE LVI.—They had now (said Prof. Smyth) arrived at a portion of the subject which might be considered as a kind of appendix to mining—namely, the preparation of the ores for market; and yet it was, nevertheless, most important, especially in these days, to understand something of that subject. There are ores of a certain class which now give remunerative results, which could not have happened under the modes of treatment practised by the old miners; and there is no doubt but adventurers of the present day have great advantages in regard to the preparation of the minerals for the market. There are few mineral substances which do not require some kind of treatment after they are brought to the surface, before they are fit to be sent to market. They might except, in a broad way, building stone, slate, and some seams of coal; but even these are mingled in their natural repositories with materials which can only be considered as refuse; and great harm may be done without constant supervision in this respect—as, for instance, in such cases as that of building materials—by the admission of stones into public and other buildings which ought to have been rejected as bad. The same remark holds good with all stratified deposits. With regard to coal, he had already pointed out how necessary it is, in working, to get rid of considerable masses of material mixed up with it, to be left at the bottom of the pit, or packed in the goaf, to avoid the great unremunerative expense of raising it to the surface. In the case of ironstone, also, it sometimes happens that the richer ores are marred by the presence of inferior stuff, which if sent away to the smelter with the ore would injure the prosperity of the mine by getting it a bad name. And when we come to metalliferous substances the intrinsic value of which is higher these matters become of very great importance. In the case of mineral veins, for instance, it is often found that they contain divers substances, and it is essential to know what to do with them. We may find in getting tin ore a variety of materials, with here and there spats of iron pyrites, spats of copper ore, and iron, with also little crystals of tinstone enough to make it valuable as tinstuff. Some of these stuffs are very poor, but from the high price commanded by tin, if 1 per cent is obtained it will pay. But to obtain this we must apply the proper processes, or what is called "dressing" in England, and "aufbercitung" in Germany. In the latter country and in France elaborate treatises have been compiled upon the subject, but in England we have not any one book about it, although there is much information scattered here and there in works devoted to other topics. In this way a good deal may be gathered from Sir H. De la Beche's reports on Cornwall and Devon, a paper of his own on the methods employed in the lead and silver mines of Cardiganshire in preparing the ores; Foster's Sections of the Strata; and Farey's work on Derbyshire. Those who have the advantage of reading French and German will find in the scientific magazines of those countries a great deal of useful information—more, in fact, than anyone is able to master who knows nothing of practical operations. In French a book by M. Combes takes up the subject pretty generally; but the most elaborate work is that of Prof. Gatzschmann, of Freiberg, a German professor. The work most in repute in Austria is that of Von Rittenger, chief mechanician for dressing purposes in that country, which gives a full description of all the mechanism employed in preparing ores. In such a case as that he had just mentioned—namely, tin—the only possible way of extracting the metal must be by trituration, to reduce the mass to the size of peas or sand, or to an impalpable powder, and then, by means of their different specific gravities, separate the one from the other by washing. But if they had to deal with 100 tons of material to get out 1 ton of what is useful, it is obvious that great economy must be practised, and powerful machinery brought into play. The lecturer then exhibited a number of specimens of mineral in the state in which it had been got, pointing out the valuable metals, silver, lead, copper, or tin, contained in each, and the other matters present with it, the peculiar treatment requisite in each case, and the proportions of refuse as compared with the saleable metals which might be dealt with. Iron ores, for instance, could not be worked with advantage unless the refuse was small; while some lead ores of an argentiferous character would pay if they got one ton of saleable ore in many tons of refuse. In Cardiganshire, for instance, they would find it not uncommon to pound 20 tons, and to pass it through a great variety of processes, to get 1 ton of lead ore. In the case of tin, it was not uncommon to have to deal with 100 to 200 tons of material for 1 ton of saleable ore. Again, with respect to gold and silver, the percentage was exceedingly minute, as, for instance, half an ounce of gold to a ton of material, which was the yield of the St. John del Rey Mine, from which, however, enormous profits had been realised—as much in one year, some time ago, as 60,000*l.* In Hungary, where the expenses of the working were smaller, and water-power very cheaply applied, the yield was as more than 3 or 4 ozs. of gold to 50 tons of material; and at Zeit and Barry 3 ozs. to 50 tons was found profitable. This was the result of a good deal of study, and the experience of generation after generation of miners. Before going further into details of trituration, he would say a few words as to those classes of substances which were not metalliferous. In slate, a great part of what is got must be looked on as waste and refuse. A stranger going to a slate quarry would see an enormous amount cast aside as rubbish, and he would frequently observe large slabs which it seemed a shame so to treat; but it must be remembered that slates had to be sent great distances to markets, and nothing, therefore, can be removed that is not saleable. In the Festiniog district ¼ of valuable slate is made out of 11 or 12 tons of slate rock as it comes out of the quarry, but in other parts of the Principality they had for each ton to break down 20 or 22 tons; and, therefore, unless there is something very special in the quality, quarrying will not be remunerative. Again, in getting building stone much of the prospects of profit depend upon the separation of the rubbish from that which is removed for sale. China-clay was a material, also, which required preparation for the market. It was found in Cornwall and Devon in the granite districts, where the felspar was changed from a solid state to a powdery condition, and when mixed with water it comes away like London milk in appearance. It is then passed through a series of long troughs of wood, called mica pits, in which a settlement takes place. This is repeated, until the water has carried off all the extraneous material, and left the china-clay in a state for the market. This process had a good deal in common with the mode of dealing with orey minerals. In the latter case the first step is to carefully subdivide underground the mineral won, by which a good deal of work at the surface may be avoided, and the richer material not dealt with along with the poorer, by which a great deal of its value may be lost. There will naturally be in a mine a great deal of mere "attle," or "deads," which should be carefully separated, and left below. What is brought up is then reduced in size at the surface, by "spalling," "grating," and "washing." The arrangements for these processes vary according to the circumstances of each mine, and the way in which it is proposed to pay the expenses of dressing. Sufficient tip-room should be left to enable the different kinds of ore, as divided below, to be tipped into separate places. By these preliminaries more attle is got rid of, and the "stuff" prepared for more minute manipulation. Machinery of more or less simple kinds is now largely employed in spalling, and Blake's Stone-Breaker has been found as useful as it is an ingenious apparatus, breaking up the hardest stone with great facility, and getting through a large quantity of material in a little time in a cheap way. With regard to the payment of the men for the work, it is found the best plan to make a bargain with them to spall at so much per ton. Another great improvement in these preliminary points is the revolving griddle, or sieve, which can be turned by the expenditure of a small amount of power; and which is inclined at a certain angle, instead of being placed horizontally. These are also employed in collieries for the separation of other mineral from the coal, which when imperfectly done results, in those used for household purposes, in cracking and flying about a room, arising from shaley matters that will not burn. These have to be removed by a sort of dressing, and some sorts require a great deal of labour for that purpose. For house purposes, too, it is necessary to get rid of the smaller coal, or slack, and this is done by a process of griddling; and in the soft coal mines of the North of England a great deal of attention is bestowed upon this operation. Inclined planes of grating are used, through which the smalls fall into wagons beneath, and the larger pieces roll down into wagons at the lower end of the grating. In this manner a great amount of division and subdivision is obtained, resulting in several sizes of coal, designated "duff," "pease," "nuts," &c.; and when possible it is a great advantage to coke the smalls, to facilitate which processes of washing had been adopted of late years.

LECTURE LVII.—So far as metalliferous ores went, spalling and crushing were but comparatively preliminary parts of what is termed "dressing the ores," and, indeed, were more analogous to hand processes than anything else. At the present day, however, wherever steam or water power is available, it is found preferable to employ either of these agencies, and the result had been the appearance of a totally different class of machinery. Of these, however, as they were exceedingly numerous, he could only place before the students some of the principal kinds of this sort of apparatus. At the outset, while it might be desirable to reduce the whole of the materials to a state of impalpable powder, in other cases it might only be advisable to reduce them to a comparatively small size—say, to the size of grains, instead of powder. He might illustrate this by the example of a nut. What was desirable in this case was to give the nut only such a blow as would enable them to get out the kernel whole—for if they were to apply to it such a force as would break the kernel as well as the shell, then the kernel would lose much of its value. In like manner, when dealing with certain kinds of ore, if they were to crush them into a state of powder they would thereby depreciate their value to a greater or less extent. This, however, seemed to be forgotten by those who were constantly inventing triturating machines, and patenting them to give them greater value, although, for the most part, they were time and money thrown away. In some cases picking or cobbing hammers might be used advantageously with machinery in treating copper ores; for this reason, that with the aid of these hammers they would chip off some portions in a state suitable for "jigging;" but if they employed machinery only they might reduce the ore too small for jigging. It would be well also to adopt the method of sorting that portion of the mineral in the condition of grain from that in a state of powder, and for this purpose a sieve was used. Of the other classes of apparatus for grinding one of the first that suggested itself was the ordinary pestle and mortar, which was employed where a small quantity only of the material had to be broken up. In the outlying mines of Australia, California, and Transylvania an apparatus of this kind came in very usefully, as it answered the double purpose of partly triturating and partly amalgamating the ores, and thus a man accustomed to the work, and having an iron mortar and pestle, would be able to impart the particular kind of movement best suited for effec-

trituration and amalgamation. A very convenient little machine of the ke class was used with considerable success at the Dolgelly Mine. It was wn as "Britten's machine"—a man of that name having been the inventor. other modes of grinding was that of employing "arrastres," which they might in use for grinding flints, by means of which the material was reduced to an alpable powder. ("Arrastre" is a Spanish term for a mill for grinding .) In the grinding of flints in the Potteries, whilst the mass of chert was g agitated and reduced to a fine powdered state it had an appearance similar ream. Another mode of grinding was that of having large "edge-runners," ich consisted of a couple of millstones, united by a horizontal axis passing ough the two stones, and attached in the middle to a vertical axis. The nes were commonly lined, and had edges of cast-iron, and the rotation was cted by a spindle. Large runners of this kind were exhibited at the last hibition, and he might remark that this and all similar kinds of apparatus e only applicable where the material was to be reduced to a state of powder. e of the greatest improvements in this department of mining was the intro- tion in the beginning of this century of a crusher or grinder, in which the ole of the orey material was reduced between cylinders rotating towards each er. This machine was first introduced in the neighbourhood of Tavistock, m whence it spread into Cornwall and Wales, and it was not until some e afterwards that the continental miners, who had been in advance of us in y matters connected with mining, borrowed the idea. The machine in ques- n was upon the same principle as the coffee-mill, and was not unlike the chine, upon a larger scale, for reducing coal, and putting it through the wash- process. There were a few points to be noted with regard to the rollers con- ted with these machines. Generally speaking, they were rather short com- ed with the diameter, and it was necessary that everything about the appa- us should be of the greatest strength. The rolls, as generally made at the sent time, were from 18 in. to 3 ft. in diameter. In the North of England it s customary to employ three pairs of rolls, the first pair being channelled, d the material having been broken up by them to a certain size, it slid down the second pair, where it was further reduced in size, and it was afterwards sed on to a third pair, which crushed any portion of the material which had been ground sufficiently fine. In the West of England it was more usual to re only one pair of rollers, and where they were well managed they worked ter than the triple rollers; but it might be objected that more manual labour s required for breaking up the material to a uniform size where only one pair rollers was used, so that it might be well to have a small pair for further re- ing the material which had not been sufficiently ground. The rolls should made of the best, or No. 3, cast-iron, and it had been sought to render them l better by employing chilled iron, but this not having been found to answer ll such was the friction of the rollers that, after a few weeks' wear, they would in practice the ordinary iron was preferred, but of the very best quality. sent such a worn and uneven appearance that large pieces might be passed ough them without coming into contact with them. In some instances the chine was so constructed that the shell could be renewed when the rolls be- e very much worn, and for this purpose it was usual to keep several shells stantly in readiness on the works, so that no delay might occur. At some es each pair of rolls were made of the same diameter and length, but at others was preferred to make them of different lengths. Thus, at the Devon Consols e, where perhaps a larger quantity of "dradge" ore was crushed than at any er mine in the world, the first pair of rolls were 34 in. diameter, and 22 in. g, while the second were 24 in. long. It was asserted that by making the ls of these proportions the surfaces were kept in better condition than if they re made of the same length. The crusher in operation at the mine he alluded was capable of crushing 15 tons of the better class of ores per hour; but if the s were of the poorer description the quantity would be much less, as the pro- tion of pyrites would be greater. He also instanced the case of a crusher of ich the rolls were 30 in. diameter, and only 17 in. long, and the other 24 in. s machine was capable of crushing 20 tons of a certain class of ore per hour. s amount of work, however, was not by any means that ordinarily performed these machines; but they might expect an efficient machine to grind down m 20 to 80 tons in the day of ten hours. Other questions which arose in- ence to these crushers were at what rate they should be made to revolve, and ht the materials to be put in dry or wet. These were very important ques- s, but no *à priori* answer could be given to them. It had been settled that circumference of the rolls should not revolve at a less speed than 30 ft., nor e than 80 ft. per minute, the average being about 40 feet. If they revolved too low a speed a proper amount of work would not be obtained from them, d if the speed were too great the material would pass through without being perly crushed. Water-power had frequently been employed to turn the rolls, latter being connected with water-wheels, intermediate gearing having to employed to secure a proper speed. With reference to the introduction of ter, it could not be denied that, in some cases, this was a decided advantage, It facilitated the grinding very much. With some materials, however, it uld not be desirable to introduce water—such as argillaceous ores, which re- ire washing before submitting to any treatment whatever, and in these in- nces it would be found that if they put them into the hopper they would be nded into a tenacious mass, which would only pass through the machine h great difficulty. But if the ores were associated with fluor-spar, water ght be advantageously mixed with them, as it would keep the surface of the ls cool, and would also assist in carrying the material through the different rts of the machine. The latter, indeed, was a great point in regard to the nomy of the crushing process, and if the material to be passed through were table, they should endeavour to so arrange the machine that a stream of ter should enter at one point, and, carrying the ores along with it, pass out a further point.

LECTURES LVIII., LIX., LX.—In these lectures Mr. Smyth con- ued his description of the processes used for the preparation of ores a copious use of drawings and working models (of which the Jermyn- reet Museum possesses so remarkably a perfect selection), so that it is fficult in words to convey to the general reader more than a bare tline. The modes of attrituration and crushing he had described st be followed out with a great degree of attention and minutiæ when applied the ores of gold, silver, tin, and all others of which the intrinsic value was eat. The precious metals may be disseminated in very small proportions rough the halvan in which they are enclosed; and in order to utilise the hal- an to the fullest extent, it might be necessary to reduce it to powder; but the stake is frequently made to carry that operation so far as to reduce those sub- ances to an impalpable powder. That is no advantage, but often the reverse, r with regard to tin and gold it is best to get the grain of a comparatively rge size; while it is desirable, as to silver, for the purposes of amalgamation, reduce it to a very fine powder. This is an important distinction, and, there- re, crushers of different powers are necessary. When the material is intro- ced to water for the purposes of dressing, we very frequently see, in a lead ine, a blue scum floating away with valuable galena, which, notwithstanding s specific gravity, has been reduced to too fine a powder to sink with sufficient pidity, and thus 30 or 40 per cent., probably, will be lost. The Spanish arras- s has been used in this country for some time. It is a circular trough, in which ocks of stone are drawn round by mule power. It is now at work in the Pot- ries, for the purpose of grinding flints. A suitable space is enclosed, and the or is composed of large blocks of chert from the mountain limestone, and of ocks of the same material driven round until the flints are ground to a fine wder, and are taken out in a sort of cream for use. A similar apparatus is ed for grinding the quartzose vein-stone in which gold is frequently found; nd in certain gold mines in the North of Italy which have been attended with reat success, a similar plan, on a smaller scale, has been used. The objection this method is that the material is brought to so fine a powder that a large antity of the precious metal floats away with the water, notwithstanding the reat specific gravity of gold. Modifications, however, of this apparatus are sily made. Another contrivance is the Chilian mill, which is very like the ill in which mortar is worked in this country, which is very well suited for nstuff. The Californian gold discoveries have led to the formation of a num- r of different classes of apparatus, many of them by persons not conversant ith those in vogue already, and by degrees all have been found wanting, and e miners have been glad to fall back on the old stamps, which have been proved two or three centuries experience to be the best. The lecturer then exhibited odels of the Saxon, Cornish, and Hungarian apparatus, as well as an American e now at work in North Wales. The modifications of this implement were, owever, innumerable. In many mines this work was carried on upon an enor- ous scale, in consequence of the necessity of getting through a large quantity material. He knew mines in Cornwall where they got through 30,000 tons in year, while in various foreign mines from 60,000 to 100,000 tons were not un- sual, and, therefore, they required a large number of apparatus of this kind, nd good engines to work them. At Shemnitz, in Hungary, and at places in ransylvania, they had no fewer than 2000 heads of stamps going night and ay, and, therefore, the amount of profit, or perhaps whether they pay or do not ay, will depend mainly upon the machinery employed. Iron stamps are an ad- antage over wood on account of their greater weight, and steel stamp-heads ad been tried, but with what result he was not prepared to say. These heads ere made of different weights, according to the nature of the substance to e pounded. If it were of an aluminous nature one and a half or two and a alf cwts. would be sufficient, but where they had to deal with gold and tin uffs, which were tough and hard, very considerable weights indeed were re- uired. The methods of lifting the stamps varied in different districts. Of ourse, they all worked in a box called a cover (pronounced kofer), and formed very strong material. Sometimes they were arranged for dry stamping, when he ores were rich and were not wanted to go through water, and in such a way s to require no second blow, the broken material passing away down an inclined rating, which separated the smaller from the larger pieces. One point in this rrangement was to have plenty of grating area, so that the material might scape as soon as pounded. To this great attention is paid in Cornwall, as a eans of avoiding considerable loss; whereas in the case of the stuffs in which he metal is more thinly disseminated it is necessary to have the kofer grate ne and uniform. With respect to the bed or bottom of the kofer, the practice n Cornwall is to select the very hardest stone that can be found in the neigh- ourhood, and that is preferred to an iron plate. The average height from hich the stamps fall was from 8 inches to 1 foot, and if the machinery was in ood working order, fifty to sixty blows per minute would be given. Of course he noise made by these stamps is overwhelming. When there are a hundred eads going speaking is out of the question. Examples of this work on a large ale exist at Redruth, and at the Carn Brea and Botallack Mines, and in East ornwall, and there were considerable variations from the ordinary systems in se in the Lake Superior districts of North America.

Besides stamping, several other kinds of action had been suggested, but none f them were capable of yielding the same results on a large scale; and he would, herefore, pass to the next point—the separation of one material from another fter they leave the stamps. When the material comes away from the grating s led into a series of ties or troughs, in the construction of which there was a reat deal of difference. Sometimes they were only 6 or 8 ft. long, and at others or 18 feet. The heavier material is deposited in the upper part. The second e retains the next less large part of the material, and allows the rest to run ver into the next tie. In Hungary the system is to make the first tie of a cer- in angle, so as to allow the richest matter to be deposited, and then by arrang- g the next tie at a different angle, the second class in value of material is de- osited; in the next, a third kind of deposit, and so on, until the stream comes lmost to a standstill, and an extremely fine material is deposited; and then, astly, come the slime-pits, which every miner ought to employ, when dealing with tin or silver. The different arrangements of ties, as suitable to different etals and materials, were described by drawings at great length, including he process of "buddling," Mr. John Hunt's apparatus being mentioned with pproval. He also explained other kinds of buddles, especially those used for slimes of an argillaceous nature, which are extremely difficult to manage. The construction of "frames" of various kinds also was treated on in considerable detail, and a great number of contrivances by different inventors compared. Of these, the contrivances of Mr. Percyval Johnson and of M. Rittinger received great praise. Various kinds of "jigging-sieves" were exhibited, and one with continuous action, was described as being applicable, and used now for the washing of coal, by which thousands of pounds worth of small coal, it was hoped, would be utilised. In reference to these contrivances, Professor Smyth said that everybody had heard of the gold "cradle" of California. That was an apparatus which was far from perfect—indeed, it was exceeded in perfection in the days of Agricola, 300 years ago. It allowed so large a quantity to go to waste, that in some localities what the first miners had left as refuse had been washed over by others a second and a third time, and, probably, a good deal of the precious metal was left even then. There was no part of what was included in the term "mining" in which there was so great a variety of processes as in this, or so great a field for the ingenuity and invention of an engineer.

Mr. Smythe then said:—I have now to draw to a conclusion with reference to the entire subject of our course, as well as to this branch of it. Any notes which you may have made of these lectures, or notions you may have picked up, should be looked upon only as the heads of the larger and a more comprehensive acquaintance with the subject, to be gained hereafter by experience. It will be convenient, therefore, for you to keep these headings in view, as a sort of nucleus of what you must hereafter seek to realise by experience. If these lectures should have had the effect of showing you some of the guiding principles of the most extensive subjects of mining, they will enable you, at all events, to save a great deal of time, and to systematise the studies you may afterwards take up. You may now visit mines at home or abroad with advantage, and know how to select some particular portion of the direction of mining operations in which you may have the opportunity or the peculiar talent necessary to excel in. And although in the colonies and in foreign countries a man to be a manager should be able to be a jack-of-all-trades, and begin at the beginning and go to the end, the work in England is greatly subdivided. It may be, therefore, that if you intend to pursue the profession in this country, you will devote yourself to some particular branch of it. I have pointed out the differences that exist between the working of metalliferous mines and of collieries, and the divisions into which these works separate themselves. If in the course of these lectures there is anything you think wants clearing up, I shall be very happy to assist you; but to those who have fixed upon the course they shall take in afterlife, I would strongly advise to commence as early as possible with some elementary part of the subject in a practical shape, and they will gain thereby a power over the subject which, perhaps, they will find it impossible to gain at a later period. Thus, in the matter of working mines an engineer, who knows practically the nature of the work, can best judge of the price to be paid for it. With regard to the subjects which have formed the topic of the late lectures, they will give you a general idea which will be useful to you, but a perfect knowledge of it must be the result of much study. If I can be of use to any of the gentlemen of this class who may be visiting foreign mines it will give me great pleasure. (Loud applause.)

STATEMENT OF BLAST-FURNACES BLOWING.

NORTH STAFFORDSHIRE.

Works.	Owners.	Built.	In blast.
Apedale	J. E. Heathcote	4	0
Biddulph	Robert Heath	6	6
Clough Hall	Trustees of the late Mrs. Kinnersley	4	3
Fenton Park	Fenton Park Iron Co.	2	1
Goldendale	Williamson Brothers	4	3
Lane End	W. H. Sparrow and Son	3	2
Shelton	Earl Granville	8	6
Silverdale	The Silverdale Co.	4	3
Talke	North Staffordshire Iron Co.	2	1
	Total	37	25

YORKSHIRE—WEST RIDING.

Beeston Manor	A. Harding and Co.	2	2
Bowling	Bowling Iron Co.	6	4
Elsecar	W. H. and George Dawes	4	2
Milton	W. H. and George Dawes	2	2
Farnley	The Farnley Iron Co.	4	3
Holmes, Parkgate	Parkgate Iron Company (Limited)	3	3
Low Moor, Bierley	Hird, Dawson, and Hardy	8	6
Thorncliffe, Chapeltown	Newton, Chambers, and Co.	2	2
Worsborough	Worsborough Iron Co.	1	1
York Road	R. and W. Garside	2	2
Hepworth	Hepworth Iron Co.	2	1
	Total	36	28

DERBYSHIRE.

Alfreton	J. Oakes and Co.	3	3
Butterley	The Butterley Co.	7	6
Clay Cross, Codnor	The Clay Cross Co.	3	3
Denby	W. H. and George Dawes	4	3
Morley Park	C. C. Disney	2	2
Newbold	S. Beale and Co.	1	1
Oakerthorpe	Oakerthorpe Iron and Coal Co. (Lim.)	2	0
Renishaw	Appleby and Co.	2	1
Sheepbridge	The Sheepbridge Coal & Iron Co. (L.)	2	2
Stanton	The Stanton Ironworks Co.	4	4
Staveley	Staveley Coal and Iron Co. (Limited)	2	2
Unstone	H. Rangeley	1	1
West Hallam	H. B. Whitehouse and Sons	3	2
Wingerworth	Wingerworth Iron Co.	3	2
	Total	39	32

NORTHAMPTON AND LINCOLNSHIRE.

East End, Wellingboro'	T. Butlin and Co.	3	2
Heyford, Weedon	Heyford Co. (Limited)	3	2
Trent, North Lincoln	W. H. and George Dawes	3	2
Frodingham	Cliff and Hunt	1	1
North Lincolnshire	North Lincolnshire	1	1
	Total	11	8

SHROPSHIRE.

Dark Lane, Horshay	Mrs. J. Botfield	4	3
Dawley Castle	Coalbrookdale Company	2	2
Lawley, Lightmoor	Coalbrookdale Company	2	0
	Coalbrookdale Company	2	1
Ketley	Ketley Company	1	1
Lodge Wood, Prior Lee	Lilleshall Iron Co.	9	7
Madeley Wood	Madeley Wood Co.	3	3
Madeley Court	W. O. Foster	3	2
Old Park	Old Park Iron Co.	4	2
	Total	29	21

SCOTLAND.—GLASGOW.

Gartsherrie	W. Baird and Co.	16	10
Coltness	Coltness Iron Co.	12	9
Summerlee	Wilson and Co.	8	5
Dundyvan	Trustees of John Wilson	3	1
Langloan	Robert Addie	6	4
Govan	W. Dixon	5	1
Calder	W. Dixon	8	6
Carnbroe	Merry and Cunninghame	6	4
Shotts	Shotts Iron Company	4	3
Castle Hill	Shotts Iron Company	3	0
Omoa	R. Stewart	4	2
Wishaw	Wishaw Iron Company	3	3
Monkland, Chapelhall	Monkland Iron and Steel Company	9	6
Clyde	Colin, Dunlop, and Co.	7	3
Quarter	Colin, Dunlop, and Co.	2	2

EAST COAST.

Kinniel	G. Wilson and Co.	4	3
Almond	J. Russel and Son	3	2
Carron	Carron Iron Company	4	3
Lochgelly	Lochgelly Iron Company	4	1
Gladsmuir	C. and A. Christie	1	0
Lumphinans	Lumphinans Iron Company	2	0
Forth	Forth Iron Company	7	3
Bridgeness		2	0

WEST COAST.

Eglinton	W. Baird and Co.	8	5
Blair	W. Baird and Co.	5	3
Lugar	W. Baird and Co.	3	1
Muirkirk	W. Baird and Co.	3	3
Portland	W. Baird and Co.	6	3
Dalmellington	Dalmellington Iron Company	7	5
Glengarnock	Glengarnock Iron Company	14	10
	Total	169	101
	Furnaces blowing, 1866	137	

— *Iron Trade Review*, April 15.

FURNACES.—Messrs. H. AYDON and G. B. JERRAM, of Queen-street Westminster, have patented some improvements in furnaces, and in the method and apparatus for supplying such furnaces with fuel or other combustible matter. The first part of which relates to the employment of fuel, such as coal, coke, peat, pitch, or other like combustible matter, which is supplied to the furnace in a highly divided state, and for this purpose they first grind such fuel into a very fine powder, in which state it is ready for admission to the furnace; it is then placed in a hopper communicating with the apparatus for injecting it into the furnace. The apparatus we prefer to employ consists of an adjustable or fixed nozzle, entering into a chamber or passage communicating with the furnace, into which chamber the fuel from the hopper falls previous to its being injected into the furnace, and for which purpose they employ a blast or jet of cold or hot air, or superheated steam (at a suitable pressure) issuing from the nozzel aforesaid. The steam on issuing from the nozzel will carry with it the coal dust or other powdered fuel which has fallen from the chamber into the furnace, and thus spread it over the fire, when it will be immediately inflamed. Other fuel falling into the chamber will be injected into the furnace in like manner in any required quantity. The second part of the improvements consists in introducing the fuel into the furnace by means of a revolving barrel or shaft (hollow or otherwise) having a continuous or intermittent motion, and having cast or fixed on to it lengthwise either plain or curved vanes, similar to a fan, and which barrel or shaft by revolving slowly carries with it and pushes forward the fuel to be burnt under and into the fire in the furnace, stirring up and turning over at the same time the incandescent fuel already in the furnace. The fuel, before falling between the vanes to be carried into the fire, is passed between a pair of rollers, called "nutting rollers," by which it is made more equal in size, thereby being easier to force into the furnace. A steam-jet may be introduced above the fire, and the two means of feeding the furnace may be used conjointly if desired.

THE FOUNDER OF THE SOUTH STAFFORDSHIRE IRON TRADE.

At the meeting of the Wolverhampton Town Council, on Monday, Mr. Hayes, the Town Clerk, read the following interesting letter:—

Carke House, Newton-in-Cartmel, North Lancashire, April 19.

TO THE TOWN CLERK, WOLVERHAMPTON.

In the *Mining Journal* of Saturday, April 13, appears the following:—

"At the Wolverhampton Town Council, on Monday, Mr. Rupert A. Kettle, Judge of the Worcester County Court, was the medium of presenting to the Council a portrait of Samuel Wilkinson, who is generally regarded as the 'Father of the Iron Trade of South Staffordshire.' In his letter to the Council he said—'I have the honour to be the medium through which John Silvester, Esq., of Sandilands Towyn, Merioneth, and Frederick Silvester, Esq., North Hall, Standish, Lancashire, present to the town of Wolverhampton the portrait of Wilkinson. The grandfather of the present gentlemen resided in Staffordshire, and was on intimate terms with the great ironmaster, and, as was not unusual, exchanged portraits. The portrait I now beg to hand you has remained in the Silvester family until now, so that its authenticity is beyond doubt.'"

Allow me, for the information of the Town Council of Wolverhampton, to state what I hope will make it appear very clear that the name of the 'Father of the Iron Trade of South Staffordshire' was John Wilkinson, not Samuel Wilkinson. About the middle of last century, or, perhaps, a little before, Isaac Wilkinson, his wife, and his two sons, John Wilkinson and Wm. Wilkinson, and a daughter, Sarah, who afterwards married the celebrated Dr. Priestley, came out of some part of Cumberland to the village of Backbarrow, in High Furness, North Lancashire, and for a suitable consideration had liberty given them to take metal in a melted state out of the iron furnace at that place, belonging to the Backbarrow Iron Company. Isaac Wilkinson and his sons carried the melted metal in large ladles across the public highway to an adjoining shed, and poured it into some moulds they had there, and thus made the common, flat, smoothing iron, same as those now in use, all which clearly proves that at that time they were in a very humble way of business indeed. But both Isaac Wilkinson and his sons were of a bold, daring, and inventive turn, and even at that time ventured to excavate and cut away some large clay-slate stone rocks behind their residence, about 150 yards from the iron furnace, in order to make them into fruit walls, the irons which once served to hold the trellis work to the rock being still visible, though the fruit trees and the trellis work itself have all disappeared. Some time after this Isaac Wilkinson and his son John erected an iron furnace and forge, at Wilson-house, near Castle Head, not far from the village of Lindale, in Cartmel, North Lancashire, and there they tried to smelt the hematite iron ore of the neighbouring district of Furness by means of peatmoss in a raw state—In the shape of peats dried in the sun, and peatmoss in a charred state; but the experimentwas a failure; it did but very partially succeed, and was, therefore, given up, and recourse had to charcoal, plenty of which was always attainable in the neighbourhood from the numerous coppice woods. About this time John Wilkinson invented the common box smoothing iron, and used to grind the bottoms of the irons by means of a large grindstone, turned by a water-wheel, which stood on Lindale Beck, at a place called Skinner Hill, close to Lindale village. After this time Isaac Wilkinson, then rather old, and his clever son, John Wilkinson, were much connected with Staffordshire, and erected ironworks there, and as they became more and more successful and prosperous erected, or became possessed of, ironworks and furnaces at Bersham, Brymbo, Bradley, Snedshill Willey, and other places, so that ultimately (after Isaac Wilkinson's death) John Wilkinson became so famous as to be commonly called "The Great Ironmaster." John Wilkinson was the inventor of boring cannon and cylinders from a centre, and thereby enabled the great James Watt at once to make smooth and perfect the action of the pistons of his pumping and other engines. He (Wilkinson) was also the inventor of iron shipbuilding, the first iron ship having been built by him at Willey, in Shropshire, this iron ship having afterwards traded for many years on the Severn, in proof of which I beg to give the following extracts from letters now in my possession, addresssed to my grandfather, James Stockdale, of Carke, by John Wilkinson, whose brother William married my father's sister, the present M.P., W. Boulton, of Tew Park, Oxfordshire, being the lineal descendant of that marriage:—

"*Broseley, July* 17, 1787.—Yesterday week my iron boat was launched; it answers all my expectations, and has convinced the unbelievers, who were 999 in 1000. It will be a nine days' wonder, and then be like Columbus's egg."

"*Bradley Ironworks, Oct.* 20, 1788.—There have been two iron vessels launched in my service since Sept. 1; one is a canal boat, for this navigation, the other a barge of 40 tons, for the River Severn. The last was floated on Monday, and is, I expect, now at Stourport, with a lading of bar-iron. My clerk, at Broseley, advises me that she swims remarkably light, and exceeds even my own expectations."

John Wilkinson issued tokens of copper, and in 1788 silver coins of 3s. 6d. each, and also 1l. notes, as many other tradesmen of that day did. The copper coins have on the obverse an excellent likeness of him, and on the reverse a forge, steam hammer, and a workman, and by the side of a pier-head a ship lying, supposed to be the iron ship. Some of these coins, however, have on the reverse a ship in full sail. Around the edge of the coins are the words Bersham, Bradley, Willey, Snedshill, &c. John Wilkinson built for himself a residence at Castlehead, in Cartmel parish, near Wilson-house and the village of Lindale, and formed beautiful gardens out of a precipitous rock there, formerly a small Roman station; and in these gardens, at a particular place, selected by himself, he ordered in his will that his body at his death should be buried, and even wrote the inscription to be placed on the mausoleum as follows, which, however, was a little altered by his executors, and is not the inscription placed on the tomb, but nearly so:—

"Delivered from persecution of malice and envy, here rests JOHN WILKINSON, Ironmaster. In certain hopes of a better state and heavenly mansion, as promulgated by Jesus Christ, in whose Gospel he was a firm believer. His life was spent in action for the benefit of man, and, he trusts, in some degree to the Glory of God."

When John Wilkinson's body at his death (about 1808) was brought down to Castlehead, where his large iron coffin had long been kept ready by him amongst the laurel trees, it (the coffin) proved to be too small to receive the body, owing to the thickness of the lead and wooden coffins in which it was encased; the body, therefore, was temporarily deposited in an adjoining walk until such time as a larger iron coffin could be made at the works, in Staffordshire or Wales. When this new coffin was brought down, and the body placed in it, and an attempt made to dig a deep grave for it, at the place selected, it was found that the rock approached so near the surface of the ground that the huge new coffin could not be got so far underground as to place it out of sight; of course, therefore, there was no way of doing but to again disinter it, which, when done, the coffin and the body were again interred, and a pyramidal iron mausoleum (as ordered by him, of 20 tons weight) placed over his grave, not 20 yards from the drawing-room windows of the house. Here John Wilkinson's body rested about 20 years in peace, but when it was in contemplation (in 1828) to sell the estate, it was thought that the fact of his being buried so near to the residence might injuriously affect the sale of the place, so John Wilkinson's body was a third time disturbed and carried in the night, in the heavy iron, wood, and lead coffins, up the steep hill adjoining to the neighbouring Chapel of Lindale, and deposited under the pew belonging to Castlehead House, where it now rests in peace, after having been four times buried and three times disinserred, the grand mausoleum being now pulled down and taken away. *Sic transit gloria mundi.*"

I remain, Sir, your most obedient servant, JAMES STOCKDALE.

P.S.—I have sent herewith one of John Wilkinson's copper coins (1792), having on the obverse an excellent likeness of him, in order that it may be compared with the portrait presented to the Town Council. The reverse has on it the ship, but not the forge; a workman is hammering a piece of iron. Date, 1792.

THE FOUNDER OF THE SOUTH STAFFORDSHIRE IRON TRADE.—Mr. J. T. B. Bennett, of Graham-street, Birmingham, writing to the *Daily Post*, says—"Mr. James Stockdale writes to the Wolverhampton Town Council that a mistake had taken place in regard to the founder of the iron trade in South Staffordshire, they having the name of Samuel instead of John. I believe that the name of John Wilkinson is right. I have in my possession a copper coin, five years before the one mentioned by Mr. James Stockdale. On the front is a good portrait, and round it are these words: 'John Wilkinson, Ironmaster.' On the other side is a forge. You can see a furnace built with bricks, a fire, also a man working a piece of iron under a very big hammer. I suppose that the hammer is worked by a water-wheel just beneath the ground. It is of 1787. This, I think, will prove a little that the name is John, and not Samuel, the founder of the iron trade in South Staffordshire."

LOSS OF LIFE IN COAL MINES.—In November of the year 1850, the first Act for the Inspection of Coal Mines came into operation; and henceforth we have some authentic data for accidents. During the ten years from 1850 to 1860, the deaths in all the British coal mines amounted to 9090. In the ensuing five years, ending 1865, the deaths were altogether 4827. Thus, then, adding to the 10,000 deaths up to 1850, 10,000 more (in round numbers) up to 1860, and nearly 5000 more up to the close of 1865, we have in all an estimate of nearly 25,000 deaths from coal mine accidents, from the announcement of any account of them to within little more than a year of the present date.—*Edinburgh Review.*

MINERS' LAMPS.—The very serious colliery explosions which occurred last winter in Yorkshire and Staffordshire have afforded a fresh stimulus to inventive genius to provide a lamp which shall be absolutely secure against any tampering on the part of a miner. It is notorious that false keys are extensively used in some pits, the managers of which are powerless to prevent their being taken secretly into them. Notwithstanding that a miner who is detected in unlocking his lamp is liable to three months' imprisonment, the offence is committed with impunity, because locks can be fastened again by the same means which are used for opening them. For all those lamps which have padlock fastenings, Mr. John Harding, a member of a Warrington firm which manufactures the gauze for safety lamps, has invented a very simple means of sealing, without the use of any lock. When the staple has been put down over the eye (which is intended to hold the padlock), a small leaden plug or bolt is inserted in the eye. This bolt is cast with a large head at one end, and, when put in the lamp, the bolt is put in a horizontal press, which is fitted with two small dies. One stroke of a lever effects all that is required to close the lamp; the pressure forms the shank of the plug into a head, and both heads are impressed by the dies with any lettering or device that may be approved by the pit manager. These dies may be changed daily, and the leaden plugs, which can be cast by the score, have many advantages. Practically, they cost nothing beyond the first trifling outlay for lead, since, when the lamps are returned to the keeper, the fastening is instantly cut in two with a pair of nippers, and can be re-cast in a few minutes. Certain detection would follow upon any tampering with the fastening, because, even if

a miner became possessed of the plugs, he could not produce the effect of the press, while, if he cut the plug which had been put in the lamp, he could not fasten it again. The saving effected by the abolition of padlocks would many times outweight the cost of the press and mould; and the process of fastening is speedier than by the use of padlocks. It seems to us that this simple and ingenious invention is worth the consideration of any persons interested in the safety of mines, who may see the apparatus at the office of Messrs. Davies and Sons, 4, St. Ann's Square.—*Manchester Guardian.*

MINING IN AUSTRALASIA—MONTHLY SUMMARY.

THE YORKE PENINSULA MINING COMPANY (Limited).—By the mail just arrived we receive intelligence having a very favourable bearing upon the prospects of the Kurilla Mine, in South Australia, belonging to this company. This mine is situate in close proximity to the Wallaroo Mine, which has lately been turning out at the rate of 15,000 tons of ore per annum. The lodes in the Kurilla dip west, as do those in the Wallaroo. The lodes in the Kurilla have been found gradually to improve in quality as each successive deeper level has been reached, a fact in itself of a very encouraging character, but rendered doubly so by the intelligence which has reached us that the lodes in the Wallaroo are found *to improve in precisely the same manner*. When the workings at the Kurilla were suspended, a few months ago, solely from want of a little more money, the discoveries made in the 35 seemed to place success almost within the grasp, we may say, of the persevering shareholders of this company. We are glad to learn that influential shareholders are now taking the matter up in earnest, and making a persistent effort to raise further funds for the development of this promising property. If their efforts are seconded by their fellow-shareholders there seems to be a good prospect that this company, which has struggled through so many difficulties, will before very long prove that in the Kurilla they possess a good paying mine. We heartily wish them the success that they deserve for their perseverance, but must urge upon them the necessity of putting their shoulders vigorously to the wheel, and co-operating with the directors and their fellow-shareholders in raising a further moderate amount of capital. We understand that a large sum is not likely to be required. A correspondent in the colony thus writes—"The proprietors of the Moonta Mines (which have been producing even more and richer ore than the Wallaroo Mines) are involved in litigation, which may, possibly, lead to a temporary stoppage of these mines, in which case supplies of copper from this colony would be very much reduced. The new claimants are considered, however, to have so little to go upon, either in law or equity, that I should hope this fresh calamity may be spared us."

THE BURRA MINES.—In reference to our Kooringa correspondent's report concerning the discontinuance of work at the Burra Mines, we have ascertained that the determination of the directors is to stop ore-raising after the end of the present take, which will probably be about March 28, and in April it will be decided how much of the exploratory work, if any, will be proceeded with. Orders have been given to continue the works in the new shaft. The following paragraph from the *Wallaroo Times* of the 27th gives a very gloomy idea of what are likely to be the effects of the stoppage:—"The contemplated stoppage of the Burra Mine is one of the most serious items of news that has reached us for some time. It is so in many points of view; the stopping of one of our oldest and largest mines, that has been looked upon almost as one of the wonders of the world, is a serious matter, and likely for a time to have a rather depressing effect upon the mineral reputation of the colony. Then the sudden throwing out of employment of 500 men, at a time when work is by no means plentiful, is a circumstances to be greatly deplored. If the stoppage of the mine continues our mineral exports will suffer, so far as it is concerned, to the tune of about 90,000*l.* a year. The coal trade and the smelting company will also be affected by the change. We have consulted the last published report of the Burra Company, in October, 1866, and we observe the state of the mine at that time was generally satisfactory. Ore was raised at the rate of about 500 tons per month; and 448 hands, all told, were employed. We fear the low price of copper must have determined the directors to 'knock the bal,' but we would fain hope it will not be long before the market improves so as to enable the old mine to be worked again. The Burra has to contend against a rate of carriage which would probably shut up several of our Peninsula mines if they had to pay it. It may be long before it is again worked, but if a new and spirited proprietary obtained possession of the mines, and if a railroad were made to to the Burra to carry down the ore, it might be profitably resumed, and we do not despair of seeing this accomplished."

COBALT DISCOVERY.—We understand that a discovery of cobalt ore, expected to be very valuable, has been made at the Cartarpo Mine, about 14 miles north of the Burra, and three or four miles west of Hallett's Hill. The proprietors have been quietly working their claim, and have already raised several tons of first-class ore, which they purpose shipping to England by the first opportunity after the arrival of the April mail. Samples of ore have been analysed in the colony by Messrs. A. Thomas, Ey, and Cossins, and have yielded oxide of cobalt varying from 7 to 16 per cent. No samples from the mine have yielded less than 5 per cent. Messrs. Johnson and Matthey, the eminent analytical chemists of Hatton Garden, have promised a full analysis and report by the next mail, but we are assured that a sample assayed by them which had been forwarded by a private party from the colony was found to contain nearly 11 per cent. of cobalt. There is neither arsenic nor sulphur in the ore—a fact which will bring it into most favourable competition with that procured from the Continent. The value of cobalt ore varies from 6*l.* to 10*l.* per unit per ton, and in some cases probably more, the price per unit depending on its richness.

WALLAROO MINES.—The new steam-whim and crushing-engine, which has been started successfully, is a 22-inch cylinder rotator engine, manufactured by Messrs. Nicholls, Williams, and Co., of Tavistock. It is a splendid piece of machinery, and it reflects great credit on Mr. Congdon, under whose superintendence it has been put together. The hauling gear is at present connected with only one shaft, but it is intended that the engine shall draw ore from three shafts when the necessary gear is adjusted. It will also set in motion an ore-crushing mill, the machinery for which, however, is not yet completed. The engine-house, which is a strongly-built fabric, is 45 feet high, and the stack is about 60 feet in height. We understand Milne's lode, at the Wallaroo Mines, is turning out very well indeed, and yielding fine ore. The Wallaroo Mines never looked so well as at the present time. The number of hands employed on the Wallaroo Mines is about 600. The average quantity of ore raised monthly is 2000 tons, at an average percentage of 12.—*Wallaroo Times.*

AUSTRALIAN MINES.

YUDANAMUTANA COPPER.—The superintendent (March 29) states—"Since my last I have shipped 28 tons of copper, and have now at the mine and in course of transit to port a further quantity of 56 tons." Captain Anthony (March 16) reports—"Blinman Mine: Nine men are employed, as stated in my last, stoping the back and bottom of the 10 fm. level. Ore broken during the month 30 tons of 15 per cent. Ore smelted during the month 221 tons, and copper made therefrom 30 tons of 95 per cent. This is a low yield, owing to a poor pile of smalls being smelted, which had to be removed to make room for the halvans from the ore dressers."

WORTHING.—Adelaide, March 28: In the 73 south, although the end is hard, the lode holds good. There is a new feature in the 73 cross-cut—the flookan is now carrying peach and virgin copper in fine particles. The rich bunch in the 73 is about 6 fathoms long before we got the change of ground, and will yield a good supply of ore. We must gain repeat that the low price of copper is the cause of the non-payment of dividends. We are accumulating a balance in hand, and hope to show by our annual meeting sufficient to cover all liabilities. Quantity of ore raised and dressed during the month about 220 tons, of about 10 per cent. Number of hands employed, 133.

GREAT NORTHERN COPPER.—Captain Tonkin (March 8)—Nuccaleena Mine: I have examined this mine on the surface, and as far as I could go underground, and find the lode runs east and west; it has a good iron gossan back, which indicates a large deposit of copper below. I do not know the height of the backs above the water level, but I should say not less than 50 fms.; this height of back is a deep mine, and can be worked without any water charges. I am of opinion that there are thousands of tons of ore here about water level. There is also a large quantity of ore, say from 10 to 15 per cent., and which by the erection of smelting works near Oratunga, where wood can be had in large quantities, could be smelted at a profit. I have been mining for 27 years, and have never seen a better looking locality. We have raised some very good ore this week.—Yandanawirra Mine: I am sinking on the course of the lode below the 7 fm. level, between the winze and No. 1 shaft, and have a leader about 8 in. wide, composed of carbonate, grey ore, and iron.

PORT PHILLIP & COLONIAL GOLD.—Mr. Bland (Clunes, March 26): Four weeks' return for February: Quantity of quartz crushed, 4487 tons; gold obtained, 1252 ozs.; yield per ton, 5 dwts. 14 grs.; receipts, 4858*l.* 13s. 8d.: payments, 5355*l.* 5s. 9d.; excess of expenditure over receipts, 496*l.* 12s. 1d. Mr. Bland writes hereon as follows:—"The above account shows a deficiency of near 500*l.* as the result of the month's work, but the board will observe that the excess of expenditure over receipts is caused by the large outlay for firewood for the year's supply, and the remittance to England for stores that have not yet arrived. These two items deducted would leave a profit of about 700*l.* for the month. This is always a difficult time of year in respect to finances, on account of laying in the winter stock of firewood and mine timber, and this year the difficulty has, unfortunately, been increased by a diminution in the yield of the quartz. The return for four weeks in March is as follows:—Quartz crushed, 4235 tons; gold obtained, 1697 ozs.; yield per ton, 8 dwts. The current month will include, as usual in March, six weeks' return. This is a considerable improvement over late returns, and I am in great hopes we may be able to keep it up. Should the current fortnight yield as well as the average of the last four weeks, it will place us in a very good financial position again. Our heaviest expenses will terminate this month; all the winter stock of firewood at the reduction works has been delivered, and will be paid for before the end of the month, and I do not anticipate any unusual expense at the mine."

ENGLISH AND AUSTRALIAN COPPER.—The manager (Port Adelaide, March 29) says that the quantity of coal at Kooringa was 1697 tons; at Kapunda, 681 tons; and at Port Adelaide, 2146 tons. At the Burra works coal continued to be stocked for winter use. At the Port all the furnaces were at work, with the exception of one refinery, which was out for repairs.

CADIANGULLONG CONSOLIDATED COPPER.—The directors have received advices from Sydney to March 23, with reports from the copper mines and smelting-works to the 18th.—Copper Mines: During the month about 85 tons of ore were raised, estimated to yield about 12¼ tons of copper.—Smelting Works: There have been shipped to London per Orwell 14¾ tons of fine copper. About 14 tons more would be finished by the middle of April. Ore on hand, about 85 tons; wood, 1672 tons.

SCOTTISH AUSTRALIAN.—The directors have received advices from the superintendent at Sydney to March 23, with reports from Lambton Colliery to the 19th. The sales of coal for the month of February amounted to 14,944 tons. Progress is being made with the new south pit. A very favourable report on Lambton coal sent to Bombay has been received.

FORTUNE COPPER (W.A.).—Capt. Penberthy (Feb. 28): In the 40 north-east end, driving by two men, the lode is producing good stones of lead ore. In No. 1 stope, in back of the 40 south-west, the lode is 5 ft. wide, yielding 3½ tons of lead ore per fathom. In No. 2 stope the lode is 5 ft. wide, same result as No. 1. In No. 1 stope, in back of the 30 south-west, two men at 3*l.* 9s. per fathom, the lode is 2 ft. wide, producing 3 tons of lead ore per fathom. In No. 2 stope, two men at 3*l.* 6s. per fathom, the lode is 2 ft. wide, producing 2½ tons of lead ore per fathom. In No. 3 stope, two men at 3*l.* 5s. per fathom, the lode is 2 ft. wide, worth 1¼ ton of lead ore per fathom. In No. 1 stope, in back of the 20 south-west, two men at 3*l.* 2s. 6d. per fathom, the lode is 2 ft. wide, worth 2 tons of lead ore per fathom. In No. 2 stope, four men at 3*l.* 10s. per fathom, the lode is 2½ ft. wide, worth 2¼ tons of lead ore per fathom. We have dressed this month 63 tons of lead ore from 75 to 80 per cent., and 7 tons of copper ore of 17 to 18 per cent.; also forwarded to port 74 tons of lead and copper ores. In store, awaiting shipment, 181 tons of lead ore and 39 tons of copper ore.

DR. URE'S DICTIONARY OF ARTS, &c.

In times like the present, when almost every day brings to light some new discovery in the arts, or some hidden feature in the sciences, seven years are sufficient to almost revolutionise the very condition of things in these departments. Research is so widespread, and discovery so rapid, that the idea of to-day becomes the fact of to-morrow, and next the history of yesterday. What wonder then that our standard scientific works so soon become old, or that by preference our scientific press is sometimes consulted for the new? It hardly needs that we enter at any length upon a statement in support of our position; the facts are self-evident, and here are a few. Within seven years the beautiful series of aniline dyes have been fully developed. Chemical industry, too, has led to the introduction and practical adoption of several other tinctorial agents. A new industry has sprung up in the production of paraffin oils from the Cannel coal and bituminous shales of the North Wales and other coal fields. The trying operation of puddling is now no longer absolutely dependent upon manual labour. Machinery is now in successful operation in several ironworks, and is gradually finding its way into many more, thus relieving man from that life-sapping labour. So with the exhausting labours of the coal miner; the work of coal-getting is now likely to be rendered more easy, and comparatively comfortable, by the introduction of coal-cutting machines. These, and a thousand other things in the many departments of the applied sciences, render necessary the occasional—and, indeed, frequent—revision of our standard scientific works, if they would preserve their position as such. Hence we hail with peculiar satisfaction a sixth edition of Dr. Ure's justly famed Dictionary of Arts,* which has been most ably edited by Mr. Hunt, of the Royal School of Mines, and whose name is as a household word with our readers.

Mr. Hunt has been assisted in his labours by numerous contributors, eminent in science and familiar with manufactures, and both he and they have taken the utmost care to include all improvements in the arts and manufactures. Especially is this observable to us in the descriptions of all matters connected with mining operations. Here, as might be expected from Mr. Hunt's thorough knowledge of the subject, the most important alterations and additions have been made. The article on the dressing of ores has been rendered very complete, and to every variety of mining machinery especial attention has been given, every change, the practical value of which has been proved, having been carefully included. The article on coal is replete with important information, and will be found particularly useful as a reference upon the question of the exhaustion of our coal fields, which occasionally crops up. It is a collection of plain facts and still plainer figures, which will require all the ingenuity of sophistry to refute, or even to distort. Of course, it is not possible within the limits of a work like that before us fully to describe all the existing coal fields. In this section, however, Mr. Hunt has selected for illustration striking types, which are sufficiently characteristic for the purpose. In concluding the notice of mineral fuel, attention is drawn to the vast importance of the subject by a reference both to the absolute and relative value of the material, especially in the British Islands. It is stated as probably within the true limit, if we take the annual produce of the British coal mines at 98,000,000 tons, the value of which is not less than 24,500,000*l.* sterling at the pit's mouth, which may be estimated at the place of consumption—and, therefore, including a certain amount of transport cost necessary to render available the raw material—at more than 33,000,000*l.* The capital employed in the coal trade is now estimated at 22,500,000*l.* The mean annual value, at the furnace, of pig-iron produced by British coal is given as 11,770,000*l.* We have thus an interesting summary upon the point in question.

In the mining department we have, first, an elaborate article on mineral statistics. The numerous tables which accompany, or rather compose it, give a very satisfactory view of the progress of the mining industries of the British Islands. Following this comes an exhaustive article on mines, in which new matter has been introduced, notably towards the close, where a section is devoted to a description of the various coal-cutting machines, and an account of the working results obtained with them in practice. But, perhaps, the most striking alterations and additions appear in the article on the dressing of ores. This article no longer retains its alphabetical position under the letter O, but has been more appropriately transferred to the letter D. The extent to which it has been improved may be imagined, from the circumstance that twelve new engravings have been added to it, whilst it occupies about nine pages more than in the last edition. These additions consist of Blake's stone-breaker, and the German sizing trommel, in the division which treats of the washing and separating of ores. In the next section, on crushing machinery, we have an illustrated description of an excellent portable crushing-mill. Under the head of stamps, is shown a well arranged stamping-mill, for the reduction of auriferous quartz, silver, and other valuable ores. Further on we come to the Hundts Setz Strom machine, an apparatus which consists of an arrangement for separating, washing, or sorting ores, and other substances, according to the size or specific gravity of the particles. Then there are rotary separators, round buddles, and specially the application of the latter to the enrichment of tin ores at Wheal Uny. Rittenger's rotating buddle, as employed at Schemnitz, and his percussion tables, are also illustrated and described in detail. To sum up, this article includes descriptions of those machines which have been long employed in our metalliferous mines, many of them having been proved by experience to be most economical—together with such of the modern introductions as appear to promise the most advantage. It also embodies many suggestions which cannot but be valuable, since the principles involved are founded upon the universal laws of gravitating power, as applied to solids and fluids in motion.

On the whole, although it may appear superfluous to speak at any length of, much less to recommend, a work with such a reputation as Dr. Ure's Dictionary, we cannot but strongly urge those who do not possess a copy to lose no time in obtaining one. Mr. Hunt knows most thoroughly the requirements of those who consult a book of reference, and he has as thoroughly met them in the work before us. It has been, for the most part, re-written and greatly enlarged, whilst the wood engravings number nearly 2000. No labour appears to have been spared to render every article strictly reliable and generally useful. Impressed with its value, we gladly commend this work to all engaged in scientific or manufacturing pursuits. Nor can we conclude without expressing our satisfaction at the way in which the work has been got up. It fully sustains Messrs. Longmans' reputation; and type, engravings, and binding are worthy of them and each other.

* "Ure's Dictionary of Arts, Manufactures, and Mines: containing a clear Exposition of their Principles and Practice." Edited by ROBERT HUNT, F.R.S., Keeper of the Mining Record, &c. Sixth edition, in three volumes. London: Longmans, Green, and Co., 1867.

STEAM-ENGINES.—Mr. DAVID JOY, of Middlesbro'-on-Tees, has patented some improvements in steam-engines, which relate to that class of engines usually designated as "high and low pressure engines," and consist, first, in running the pistons of his two cylinders, or sets of cylinders, at speeds proportionate to their pressures—that is to say, he runs his high-pressure cylinders at a high speed, such as is due to high-pressure steam, and his low-pressure cylinders at a low speed due to the pressure therein used, and either couples the two sets by suitable gearing, or he drives a screw or twin screws with the one and paddles with the other, or screws variously pitched and speeded, or paddles of different diameters, always arranging that each piston or set of pistons shall have a speed suitable to the pressure it is worked at; or he gains the difference of the speeds by giving the high-pressure cylinders a length of stroke as compared with the low-pressure cylinders to suit the pressures relatively, and carries on expansion in either set of cylinders, or in both combined; but he prefers it to be entirely effected in the high-pressure cylinders. Secondly, Mr. Joy arranges his low-pressure cylinder or cylinders as is ordinarily done with condensors, air-pumps, and other fittings, or he uses the cylinders of existing low-pressure engines, and adds the high-pressure cylinder or cylinders framed separately, and by preference in wrought-iron, and capable of being removed entire, still leaving the low-pressure cylinder or pair of cylinders entire as an ordinary engine, and he further so arranges the above framings that by a slight motion he can throw the high-pressure cylinder out of gear with the low-pressure engines, and screw or paddle shafts, and run them separately as ordinary high-pressure engines (exhausting into the chimney) for working the crabs or donkey-pumps. For land engines he combines the cylinders similary as for marine purposes, and connects by gearing or straps, or adds a high-pressure cylinder or cylinders to the existing low-pressure cylinder or cylinders. For locomotives he runs separate pairs or sets of wheels by the two cylinders or sets of cylinders, thus driving a small pair of wheels by the high-pressure cylinders, and a large pair by the low-pressure. And he makes the valves of such engine cylindrical balance-valves, forced continuously in one direction by the steam pressure, the motion being given to them by eccentrics and gear pushig them, while the steam always compels them to follow such eccentrics.

A NEW STEAM STAMPING QUARTZ MILL.—Various methods have from time to time been devised, both in California and the Eastern States, for the direct application of steam to quartz mill stamps, after the manner of the application of steam to the hammer. Our knowledge of these efforts, however, has been derived only through the records of the Patent Office, and the various scientific and mechanical publications of the East, until our attention was called, a few days since, to the recent invention of James and Condicts, one of whose mills—a small prospecting machine—has recently been sent to this city, to the charge of J. Ross Browne, our Commissioner of Mining Statistics, who has placed it on exhibition at the Pacific Foundry. This machine is quite different in its construct from any other to which our attention has been called. It consists of a battery of two stamps, the peculiar character of which is that the downward movement of the stamps is effected by the aid of high-pressure steam, while the upward movement is produced by steam at a low pressure. Of course the stamp-heads are affixed directly to the pistons. The induction and eduction of the steam to the upper portion of the cylinder, which produces the "strike" of the stamp, is made through a direct communication with the boiler, and may be kept at any desirable rate of high-pressure. The stamps are lifted by low-pressure steam, introduced into the cylinders, and kept in constant communication, without the intervention of working valves, from a steam-chamber having such a minute connection with the boiler as to keep up only the degree of pressure necessary to raise the stamps and prevent an excess of condensation. Of course, when the piston is driven down, the lifting force from the low-pressure steam-chamber, which maintains a constant resistance in the cylinder, must be overcome; but as that is only 10 lbs. to the inch, it is found more economical to increase the steam in the boiler, say from 70 to 80 lbs., to overcome that 10 lbs. of constant resistance, than to waste a whole cylinderful of high-pressure steam at every stroke merely to raise the stamp. The induction and eduction to and from the upper end of the cylinder, is alternately effected by a tappet motion produced by the movements of the stamp-stems themselves. The action of the steam which effects the blow being controlled by the upward movement of the piston, and the steam which produces the lift being constant in its pressure; the greater or less descent of the stamp, incident to the greater or less amount of rock beneath it, may always be readily accommodated. We learn from Prof. Whitney that this principle of actuating the movement of a steam piston has already been successfully applied to working rock. Some 20 years ago, a Mr. Ball invented a crusher on a somewhat similar plan, which has been for many years in successful operation in the Lake Superior copper districts. The mechanical contrivance by which the principle is applied by Messrs. James and Condicts is probably an improvement on the Lake Superior machine. We see no reason why the power employed might not be made especially serviceable for many other mechanical purposes, where the power required is unequal and reciprocating, as in the raising of full buckets and lowering of empty ones, in mines and other places, the driving of steam-hammers, &c. It is impossible to judge of the practical value of such a machine by witnessing a mere trial of capacity. It is certain, simple, and effective in its action, and by the rapidity and force with which the stamps can be driven it is possible to turn out a large amount of work with a very small machine. How it will stand the long-continued and rough usage inseparable from quartz crushing we cannot say. It is light, occupies but little room, is constructed so as to admit of a most economical use of power. We should suppose such a machine would be found especially serviceable for a prospecting mill. It is only about 2 ft. square and 6 ft. high, including stamps, mortar, and cylinder, but without a boiler; it does not weigh over 1500 lbs. The machine is well worth the attention of our millmen. It is the invention of Christopher R. James, Jersey City, N.Y. The patent was issued to James and Nathan W. Condict. It may be seen at the Pacific Foundry, in this city. J. Ross Browne is agent for the inventors for this coast.—*Mining and Scientific Press* (U.S.)

THE OFFICIAL REPORT ON THE OAKS EXPLOSION.

The reports of Mr. Dickinson, Inspector of Mines, on the Oaks catastrophe, and of Mr. Wynne, on the explosion at Talke-o'-the-Hill, have been presented to Parliament. The report of Mr. Dickinson, which is made to the Home Secretary, is dated Pendleton, Manchester, Feb. After some explanations, he says that, excepting in the greater magnitude of the calamity, there is nothing to distinguish it from a large number of similar occurrences. Mr. Dickinson says that from the testimony at the inquest there was large accumulations of fire-damp in the goaves, but as to how it became ignited no clear evidence was adduced. The safety-lamps appear to have been examined and locked as required. Blasting was entirely prohibited in working the coal, but there was a new stone-drift being driven near the downcast shafts to some steps going down into a travelling road. It was no doubt, from the evidence, that the explosion took place when a shot being fired in this part of the mine. There seemed, however, to have been no of care or discipline in carrying on the work. The special rules established enforced were of a most stringent kind; the colliery was under the manage of one of the most eminent mining engineers in the kingdom; the ventil was skilfully laid out, and, with one or two exceptions, was conducted on t censional system. To what, then, asks Mr. Dickinson, is the cause of the sion to be attributed? In his opinion clearly to the system on which the was worked. The pack-walls were built of stone, which frequently fell fr roofs of the goaves. In getting this stone out the miners had to leave their lamps outside, and go into the goaf in the dark. The system of working the pit appeared to involve this reprehensible practice, which, indeed, seems to be mon to some collieries. Mr. Dickinson suggests a plan of working wh brought under the notice of the Commons' Select Committee on Mines last and the extension of which in his own district he believes has led to a dimin in the number of accidents, concurrently with a large increase in the num persons employed. Under this system the levels are first driven out to t ends, and the coal worked back from the extremities, having a substantial wall built about 3 yards in width at the side of each working face. In way all the goaves are left behind, and the pack-walls support the roof able the ventilation to be kept up in the goaves sufficiently far from the faces. By having more men in the same face of work than only two in from many as 30 yards, as practised at Barnsley, the space of pit room requisite kept open at one time might be much lessened and the ventilation simp The accidents in Yorkshire have, however, been few in proportion to the tity of coal raised and the number of persons employed; the great dra being the occasional occurrence of very serious explosions. Under the system the coal is got at as cheap a rate as any, but it has the counterbal disadvantage that a colliery owner may have a splendid property one day, the next it may be a wreck, and the pit, as in this instance, closed. Dickinson believes that as the sinkings of our coal mines become deeper, th must be extended and the number of men increased. He looks for more in having the workings upon a proper system, such as he has recommended which he has found economical in the long run in his own district. As to a stringent system of inspection, which has been insisted upon in some qu he points out that if the inspection became too frequent the Inspectors wo likely to become implicated in the management. When, therefore, an ac took place, their position would not be sufficiently disintercsted to enabl to make an independent investigation, and it would require for that purpo disinterested person to be called in to see that the provisions of the law w forced. This would lower the standing of the Inspector, and lessen his ness in the district. The responsibility must rest somewhere. Hitherto been decided that it should fall upon the owners and managers, but if it tended that Government should assume the responsibility, then the whol ject of inspection will require re-consideration. So far as inspection migh been brought into play at the Oaks Colliery, it appears that 12 days before plosion a complaint of fire-damp in a certain part of the workings was m the principal owner of the colliery. He made a personal examination, but was found. The ventilation of that part was, however, found to be wea it was arranged that the underviewer should send more air into the wo It was discussed among the miners whether the attention of Mr. Morton be called to the matter, but it was decided not to do so, and that opportu avoiding the explosion was lost. Mr. Dickinson concludes by expressing nion that the present Act of Parliament, though not perfect, is a very goo sure, and anything in which it is deficient may be supplied by altering t cial rules when the deficiency becomes apparent.

PRACTICAL IRON MANUFACTURE.—"Silicon," writing to the Trade Review," in reference to the paper we copied into the Journal of A says—"A question was therein raised that has absorbed my closest at for an extended period of time. As it is the Cleveland pig we have to wo iron made from the Cleveland pig we have to sell, how to expel the phos from the iron becomes a question of paramount importance. Allow to take exception to one remark enunciated by your intelligent corresp "J. A. J." He says that the "mixing of a portion of hematite is rende solutely necessary by the character of the Cleveland pig." I beg to say some beautiful specimens of wrought-iron—rounds, squares, and large some with a silky fibre, others with a steely homogeneous appearance, bu good quality, and fit for any kind of work; yet it was made from Clevela (No. 4 forge), puddled in an ordinary puddling furnace, by an ordinary p without an ounce of hematite or any other mixture."

RUST REMOVED FROM METALS.—Plunge the blade in a bath luted hydrochloric (muriatic) acid; say one pint of the acid to one quart of Leave it there for 24 hours; then take it out and rub well with a scrubbing The oxide will come off like dirt under the action of soap. Should any main, as is likely, in the corroded parts, return the blade to the bath fo hours more, and repeat the scrubbing. The blade will then present the ance of dull lead. It must then be well washed in plain water several tim thoroughly dried before a fire. Lastly, a little rubbing with oil and fine powder will restore the polish. Should oil or grease have mingled with th as is usually the case, it will be necessary to remove it by a hot solution before submitting the metal to the acid. This last attacks the rust alone out injuring the steel; but the washing in plain water is all important, a the process, the metal will absorb oxygen from the atmosphere freely, if an of the acid be allowed to remain.

Works published at the MINING JOURNAL *office, Fleet-street, L*

TREATISE ON IRON METALLURGY. By S. B. ROGERS. £1 5s.
STATISTICS OF MINING (ANNUAL). By W. H. CUELL. 6d.
"CORNISH NOTES"—NEW SERIES. By J. Y. WATSON, F.G.S. 1s.
RISE AND PROGRESS OF MINING IN DEVONSHIRE. By G. CHOWE
SLATE QUARRIES IN WALES CONSIDERED AS AN INVESTMENT.
Edition. By T. C. SMITH. 1s.
SLATE QUARRIES AS AN INVESTMENT. By J. BOWER. 1s.
COLLIERIES AND COLLIERS. 1s.
VENTILATION OF MINES, FOR THE USE OF UNDERGROUND
NAGERS AND OVERMEN. By RALPH MOORE. 5s.
SECTION OF LANARKSHIRE COAL MEASURES (NEW EDITION)
RALPH MOORE. 10s. 6d.
MINERS' MANUAL OF ARITHMETIC AND SURVEYING. By W
RICKARD. 10s. 6d.; by post, 11s.
TRANSACTIONS OF THE NORTH OF ENGLAND INSTITUTE OF M
ENGINEERS. 21s. per volume. [Single copies can be had.]
TABLES FOR ASCERTAINING THE VALUE OF TINSTUFF. By C
CHARLES THOMAS. 5s.
TAPPING'S HIGH PEAK MINING CUSTOMS. 5s.
THE COST-BOOK—TAPPING'S PRIZE ESSAY—WITH NOTES AND APP
TAPPING'S DERBYSHIRE MINING CUSTOMS. 6s.
TAPPING'S COLLIERY AND ORE MINE INSPECTION AND T
ACTS. Cloth, 6s.
TAPPING'S EDITION OF MANLOVE'S CUSTOMS OF THE LEAD M
OF DERBYSHIRE. 3s.
COST-BOOK SYSTEM—ITS PRINCIPLES AND PRACTICE. 6d.
ON PUDDLING. By "A Practical Puddler." 2s.
COAL FIELDS OF THE SOUTH OF ENGLAND. By J. HOLDSWORTH.
THE PRINCIPLES OF THE COST-BOOK SYSTEM PRACTICALLY C
DERED. By T. TAPPING. 6d.
JOINT-STOCK COMPANIES, & HOW TO FORM THEM. By T. TAPPIN
THE ORIGINAL LOCOMOTIVE BY TREVITHICK. On fine paper. 2s.
MINING GLOSSARY—English and Foreign Mining and Smelting Terms.
COND EDITION). 2s.
REMARKS ON THE GEOLOGY OF CORNWALL AND DEVON. By
CHARLES THOMAS, of Dolcoath Mine, Cornwall. 1s. 6d.
FORM OF "TACK-NOTE."—UNDERTAKING TO GRANT MINE LEASE.
VENTILATION OF COAL MINES. 3d.
CORNWALL AND DEVON MINING DIRECTORY. 1s. 6d.
INVENTIONS, IMPROVEMENTS, AND PRACTICE OF A COLLIERY
GINEER AND GENERAL MANAGER. By BENJ. THOMPSON. 6s.
CONVERSATION ON MINES, &c., BETWEEN "A FATHER AND S
By W. HOPTON, Colliery Manager. 2s. 6d.; by post, 2s. 8d.
GEOLOGICAL MAP OF THE CROWAN AND WHEAL ABRAHAM MIN
DISTRICTS. By BRENTON SYMONS, M.E. Coloured 15s.; mounted, 21s.
MINES OF CORNWALL AND DEVON (Statistics of, and Observations on
T. SPARGO. 5s.; by post, 5s. 4d.

London: Printed by RICHARD MIDDLETON, and published by HENRY ENG
(the proprietors), at their offices, 26, FLEET STREET, E.C., where all com
[May 18, 186
nications are requested to be addressed.